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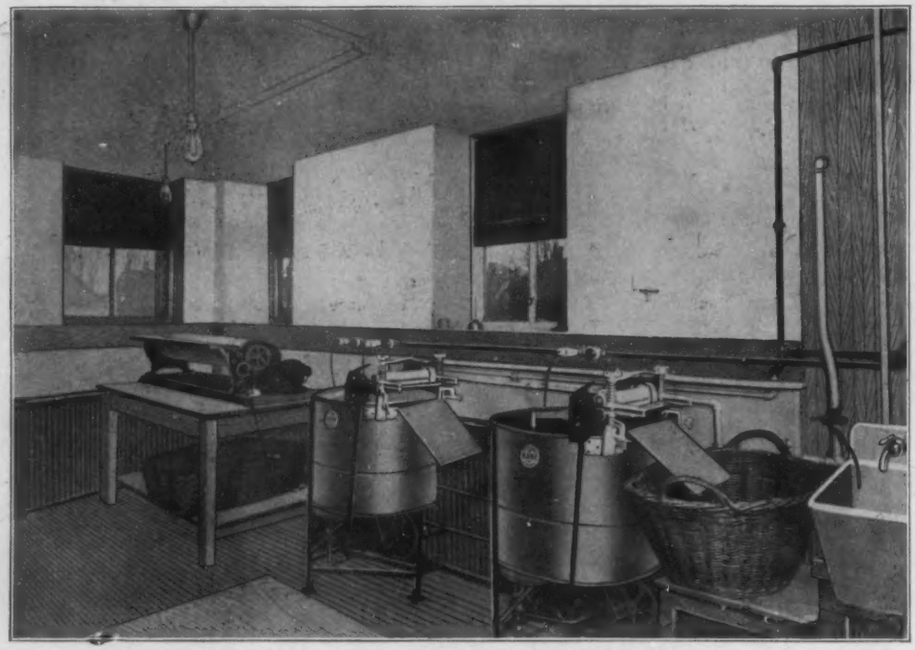

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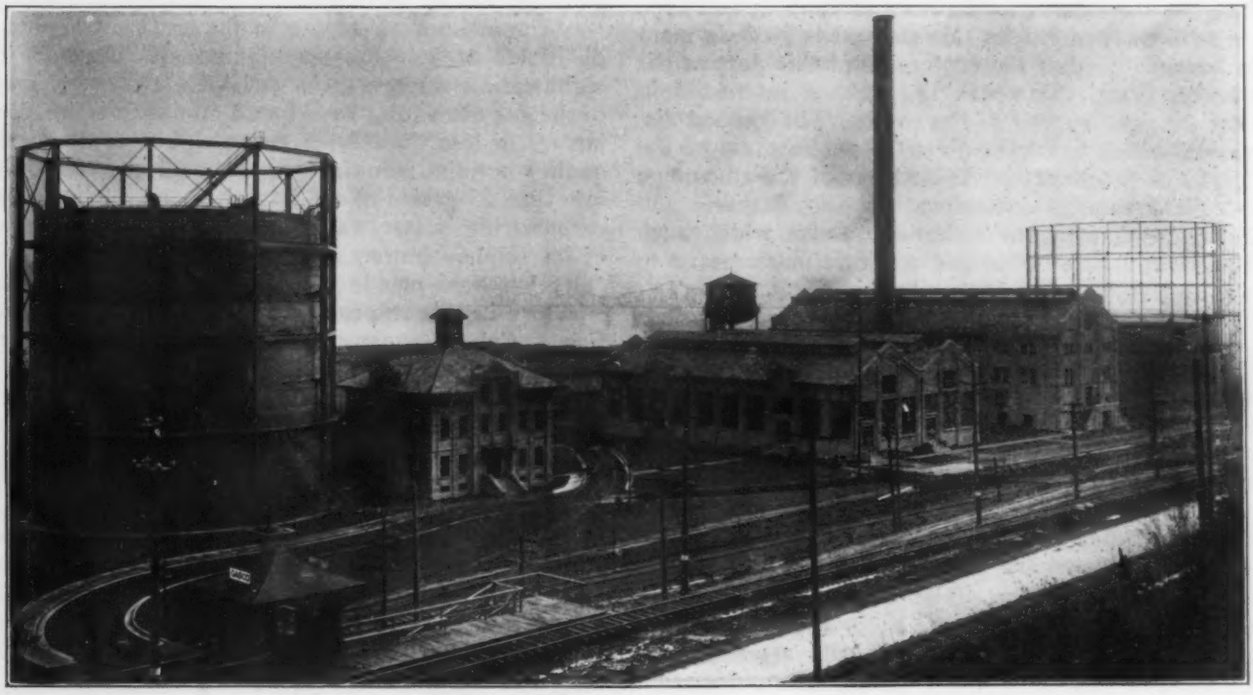
STANDARDS FOR GAS SERVICE IN THE WEST

BY R. S. McBRIDE.

(After a critical consideration of the several technical factors involved in setting standards for gas service, the author draws valuable conclusion as to points of difference between Eastern and Western practice and standards, particularly as regards heating value. The next installment will be concerned with the discussion of oil-gas conditions. Mr. McBride is engineer with the U. S. Bureau of Standards and this article is published with the permission of the Director.—The Editor.)

During the early part of 1913, the Bureau of Standards was requested by the Railroad Commission of Oregon, to make a preliminary report to the commission commenting upon certain proposed rules for gas service in that state. From time to time during the year the Bureau gave considerable attention to the question and finally during January and February of 1914 a representative of the Bureau visited the West to make a further study of gas making conditions.

This work had a two-fold object: First, gathering from the western part of the United States information of value to the Bureau in its general study of American gas making conditions, which has been a necessary supplement to work done by it on standards for gas quality and gas service. Second, the collection and study of such data as have an immediate bearing upon the question of the proper standards for gas made and sold in the state of Oregon. The material which was collected by conferences and correspondence has been utilized in the preparation of a report to the Railroad Commission, thus carrying out the second named object of the work. This material has also been utilized in the preparation of supplementary sections for Circular No. 32, which is now being revised for a third edition. Some of the



Gas Plant of Portland Gas & Coke Company.

information is of such general interest that it seems desirable at this time to give it wider publicity in the form of the present article.

Scope of Gas Service Rules.

Rules fixing standards for gas service in general give consideration to five principal technical subjects, namely, candlepower, heating value, purity and pressure of gas, and the testing of gas meters. In addition to these five subjects certain provisions are, of course, made for general regulatory matters, such as the requirement of deposits from customers, bill forms, interruptions of service, investigation of complaints made by customers, etc. It is unnecessary in the present article, however, to discuss any of the general questions, since the information gathered by the Bureau has a bearing only upon the principal technical regulations above referred to.

Candlepower of Gas.

The rules which were proposed by the Railroad Commission of Oregon made no provision for a requirement of gas candlepower. In this respect the Commission was following the practice of other state commissions, and a very cursory consideration of western conditions has indicated that there is little, if any, need to consider a requirement of gas candlepower in the states of the far western part of this country. This is particularly true of this section, since the use of gas for lighting is limited; and such use as is made of gas for this purpose is made in mantle burners, so that the customers of this part of the country, practically speaking, are not interested in what the candlepower of the gas is. The general discussion which has been given in publications of the Bureau of Standards on the subject of the advantage and disadvantage of candlepower specifications and the suggestions as to conditions under which such requirement may be needed make it unnecessary to take up this question further in this paper.

Purity of Gas.

The requirements adopted, prescribing limits for various impurities in gas, commonly take account of the hydrogen sulphide, the total sulphur, and the ammonia content of the gas. In the consideration of standards for oil gas and for the other kinds of gas made in the states of California, Oregon and Washington no unusual conditions were found which would affect these customary standards for gas purity.

Hydrogen Sulphide.—The elimination of hydrogen sulphide from gas, whether it be coal gas, water gas, or oil gas, is not difficult. It is only a question in any locality as to how much hydrogen sulphide must be cared for; and it is fortunate that in the western part of the country no unusually large amount of this impurity is found in the raw gas.

Ammonia.—Because of the high temperatures which are maintained in the generators during the manufacture of water gas or oil gas practically no ammonia is found in gas made by either of these processes. For plants using these processes an ammonia limit is not necessary. In coal gas manufacture a considerable amount of ammonia is always produced and this should be reduced within reasonable limits before the gas is distributed.

Under the climatic conditions of the western states, no difficulty should be met in keeping the ammonia content of coal gas well below the ordinary limits of 5 to 10 grains per 100 cu. ft. of gas. In almost every case where coal gas is made an ample water supply of fairly low temperature at all times would be available, and this condition greatly facilitates operation in conforming to such limits.

Total Sulphur.—The amount of sulphur occurring as total sulphur in the finished gas is usually largely dependent upon the sulphur content of the fuel from which the gas is made. The severity of any limit upon total sulphur is therefore largely determined by the character of the gas-making fuels available in the locality. The gas coal and the coke used in the coal-gas and water-gas plants of the west, are usually high and exceedingly variable in sulphur content, not only in comparing the coal from different mines, but also the coal from a single mine at different times. Fortunately, however, from the standpoint of the gas maker, the sulphur seems to be present in these coals in such a condition that the greater part of it is retained in the coke and eventually in the ash. Gas made from this coal, or from the coke which it gives, is therefore not usually high in "fixed" sulphur. As a generalization it is probably safe to say that little difficulty will be met by the western coal-gas or water-gas maker in meeting a limit of 25 or 30 grains of sulphur per 100 cu. ft. of gas.

The amount of sulphur in the crude oil or the oil distillates used in the manufacture of oil gas or for carburetting water gas is variable. However, many of the gas companies have found no difficulty in securing oil of less than 1 per cent sulphur content; this quality permits manufacture of an oil gas containing less than 25 grains of total sulphur and when used in carburetting water gas gives no difficulty because of its sulphur content. In some places greater difficulty has been met in the past in securing oil as satisfactory in this respect; and as a result the Portland Gas & Coke Company developed the re-heating process for the reduction of the fixed sulphur content of gas. However, during the past year or more, the company has been so successful in securing oil of low sulphur content that it does not find it necessary to utilize this special process. All of the information secured by the Bureau would indicate that a supply of oil of suitable character can regularly be obtained and no difficulty need be anticipated in the operation to conform to the specification similar to those commonly enforced, for example, 25 to 30 grains of total sulphur per 100 cu. ft. of gas. There is some indication that the difficulty of meeting such requirement will grow less rather than greater, since the oil distillates, which are being more and more employed for gas making, are in general of lower sulphur content than the crude oil itself.

Gas Pressure.

As compared with the eastern part of the United States, western gas distributing conditions differ in two particulars. In the first place the cities, and consequently the sales of gas, are increasing much more rapidly in the west. This has made it more difficult to maintain at all times satisfactory gas pressure without the use of some form of high pressure dis-

tribution. The very common use of the high pressure systems is the second characteristic of the west.

The use of a high distribution pressure for gas has, however, in no way complicated the matter of fixing specifications, since the high pressure distributing systems are supplemented either by district or consumers' governors, which permit delivery to the customer at pressures comparable with those used in the eastern part of the country. When this system is used the important question is for what pressure should the regulators be set.

In general no difficulty will be found in the western states in maintaining pressures above a 2 in. minimum and in many cases it would be possible, although not usually necessary, to maintain a minimum of 4 in. at the outlet of the service pipe to any consumer. In those places, which are in the majority, where a high pressure system with district or consumers regulators is employed, very little variation in pressure at any point need be allowed. Usually no more than 2 in. variations need occur on any day at any service outlet.

Some engineers have objected to the placing of a maximum limit upon gas pressure and under certain conditions such limit may not be desirable; but for domestic supply a pressure higher than 6 or 8 in. is usually not desirable since with the higher pressure on the ordinary forms of gas consuming appliances the gas is not so economically utilized as when the pressure is lower, say 4 to 6 inches. There is little ground for objection to a maximum limit of 6 or 8 or 10 in. at the consumers service outlet, if it be provided that a higher pressure can be maintained in the mains or in the customers premises whenever the customer needs such pressure for use with high pressure appliances.

The Bureau has received no information which would lead it to believe that the discussion in its Circular No. 32 on the question of gas pressure limits is not applicable to western as well as to eastern conditions. The rules which it proposes might therefore be considered applicable in general for the western states.

Testing of Gas Meters.

The Bureau has had no opportunity to determine whether a gas meter used for the measurement of oil gas operates differently than if used either for coal gas or water gas. It has been found that a considerable number of the western companies make a practice of frequent removal of meters for testing. Several companies remove all meters after 3 years, in order to test and if necessary overhaul. There is no reason to believe, however, that the period between routine, or "periodic" testing, need be different when oil gas is supplied than when coal gas or water gas is distributed. Certainly the general conclusion reached by the Bureau as to the practicable limits of accuracy for original setting and for meters when removed from service are equally applicable in the western part of the country. The discussion on meter testing requirements of Circular No. 32 needs little, if any modification for application in that district.

Heating Value.

The heating value of a gas is the best measure of its quality for most of the uses to which commercial gas supplies are put. If used for cooking, room heating, or other purposes where the heat developed is the determining factor, it is of primary importance. The usefulness for mantle lighting and for development of power in a gas engine is nearly proportional to the heating value. The heating value is, however, not a measure of the usefulness for open-flame lighting; but this is not an important consideration in the western states, since very little gas is used for lighting and practically none for lighting in open-flame burners.

The most desirable condition is therefore, that which will permit the gas company to deliver to the customer the largest amount of useful heat for one dollar of cost to the customer. This is recognized as the ideal condition, but the general principle thus enunciated has been variously applied, in some cases apparently without due consideration of the real significance of all the factors entering.

A customer is primarily interested in the quantity of heat which he will obtain on the average, but irregularities in quality are objectionable.

The variation which must be allowed in the case of oil gas is not materially different than in the case of coal gas or water gas. The discussion in Circular No. 32 of the Bureau of Standards of the subject of "Monthly Average and Minimum Values" is therefore applicable to gas made by any of these processes.

After consideration of western conditions it was evident that the numerical value which should be prescribed as the required monthly average heating value, is the only one to which particular attention need be directed. The other phases of the subject of heating value standards have already been sufficiently discussed in the publications of the Bureau.

In most cases the selection of heating value requirements has been made either to correspond with the figure required elsewhere or to the figure representing the quality delivered by the companies to be regulated previous to the time of the regulation. Neither of these two methods taken alone is a proper one. The first, because rules which are applicable under one condition may not be applicable under another; and the second, because there is no means of knowing without other investigations whether the previous practice of a company is the best, either for it or for the customers concerned.

The correct basis for a heating value standard, namely, the delivery of the most heat to the customer for one dollar, has sometimes apparently been misapplied. For example, in one case a decrease in the heating value standard was recommended in order to meet certain economic conditions, but it was not made clear that either greater economies would result or that the company's customers would benefit by this lower heating value. The companies would thus earn a larger rate of return; but it was not shown that this was necessary.

Another misapplication of the principle has been found in the case of those companies which argue that the best condition is one which will permit manufacture at the least net holder cost per heat unit. However, it is the total cost, not the net holder cost, of the heat unit which should be a minimum.

Still another way in which the fundamental principle has been modified is on the basis of "conservation of materials." Those using this argument state that

the heating value which enables one to get the largest number of heat units from each pound of coal or gallon of oil is the best. This argument is correct only in those cases in which the main principle is not violated by its application.

The correct application of the principle requires a consideration, not only of the cost of manufacture, which is directly affected by changes in quality, but also a consideration of the changes in sales with changes in heating value of the gas and their effect on all operating costs. Moreover, it is necessary to consider what changes in fixed charges, both per thousand and in the aggregate, will result from changing quality. In other words, it is necessary first to determine approximately for each of several qualities of gas what would be the proper price to charge the customer in order that all operating expenses be paid, proper allowance made for depreciation, and a proper return upon the investment assured. It is then easy to determine which of the several qualities of gas will give to the customer the most heat for each dollar paid.

The field investigations made by the Bureau were not confined to a study of Oregon conditions, although each of the eleven gas companies of this state were consulted by the Bureau, either directly or indirectly. The principle cities of Washington and California were also visited and conferences were held with many gas engineers. In addition to the information collected by personal conferences, the Bureau has obtained some information by correspondence, particularly that contained in the replies to a circular letter which included questions with reference to oil-gas manufacture only.

In taking up the question of what numerical value should be fixed for the monthly average total heating value in any particular case, the Bureau believes it desirable to consider the following questions in the order in which they are named:

1. What manufacturing limitations are there which control the quality of gas which can be made with the process under consideration?
2. What is the relative cost of manufacture for the different qualities of gas with the process under consideration?
3. What is the relative usefulness of the gas when of different qualities?
4. How will the total sales be affected by any changes in the quality of the gas?
5. What is the proper selling price for gas of the different qualities, and which quality permits the delivery of the most heat to the customer for each dollar to be paid by him?
6. What other factors enter to affect the choice of a heating value standard?

The question as to the quality of solid fuel obtainable in any locality is of minor importance in fixing a standard for carburetted water gas, since it is always possible to make this gas of the quality desired up to a limit probably somewhat above 700 B.t.u. per cu. ft. Any manufacturing limitations can therefore be practically ignored when considering water gas; and the question becomes then largely one of relative cost of manufacture of different qualities of gas.

The Bureau has found no reason to believe that water-gas making conditions are materially different in the West than in the East as far as relative costs of gas of different qualities is concerned. The following generalization of Circular No. 32 (page 29 of second edition) is therefore suggested as being applicable throughout the country.

It appears to the Bureau that unless by-products or unenriched coal gas is to be delivered a requirement of 600 B.t.u. is reasonable and in general more economical than a lower value (except when on local cubic foot basis in a city of low barometric pressure); and although this generalization will not hold in every case, it appears reasonable that when a company desires to distribute gas of less than 600 B.t.u. the burden of proof should rest upon such company to show that the local conditions are such as to permit better service with a lower heating value. If the number of heat units to be delivered for a dollar is greater with less than 600 B.t.u., then such lower value may be allowed; certain conditions where this may be the case have already been made clear.

There is no question but what water gas of 600 B.t.u. can be distributed under the climatic conditions of the Western States with small distribution losses and of satisfactory uniformity of quality when regular calorimetric tests are made. Such gas would give good satisfaction to the customer, since it is well suited to the ordinary domestic and industrial appliances, it permits efficient utilization, and with it satisfactory speed can be obtained in cooking, heating, etc.

In the selection of a heating value standard for coal gas, the first factor which must be considered, is the character of the coal from which the gas is to be made. The plants making coal gas in Washington and Oregon are, and will no doubt continue to be, supplied with coal from the fields in the south-central portion of Washington, particularly from the South Prairie or the Roslyn districts. The Bureau has information as to the results which have been obtained in Seattle, Tacoma and Spokane, as well as the results which have been obtained by the Portland Railway, Light and Power Company, at Salem, Oregon, and the Pacific Light and Power Company, at its various coal-gas plants. All of this information would indicate that there is little difficulty with the better class of Washington gas coal in obtaining satisfactory yields of a gas of 600 B.t.u. cu. ft. Indeed, from the standpoint of yield of heat in the gas, these Western coals appear to be more satisfactory than many of the commonly used Eastern gas coals. However, their poor coking quality is a disadvantage. At least from the standpoint of the manufacturing limitations, a requirement of 600 B.t.u. is not unreasonable for coal gas made in this district.

The experience of those companies which have been operating with calorimetric control would indicate that coal gas can be made with a heating value of 600 B.t.u. on the average with no serious economic difficulty. The Washington companies had been operating under such requirement for a number of years and the Bureau has not received any information to indicate that this requirement has proven to be a hardship upon the companies. Since this gas is very stable under the climatic conditions of these states, and since the 600 B.t.u. coal gas is highly satisfactory to the customer, a standard such as is in force in Washington and has recently been adopted by the Railroad Commission of Oregon, will probably be satisfactory for any coal-gas plants of this section.

[To be continued.]

LIGHTING METHODS

STREET LIGHTING—YESTERDAY AND TODAY.

BY RALPH E. CUNNINGHAM.

(This article briefly traces the history of street lighting from the earliest crude methods to the latest developments. The author is superintendent of distribution for the Southern California Edison Company at Los Angeles.—The Editor.)

R. E. Cunningham.

"Yesterday" seems entirely out of place, because as time is reckoned there was no street lighting yesterday; for the shadows have hardly disappeared which were made by the flame of the old pine knot, and the wildest dreams of the genius of yesterday did not include the present day principles involved in street lighting. The history of street lighting is the history of human progress during the past century. By leaps and bounds, springing as it were from nothing, until all the known forces of nature are contributing to the desired end. Light has always been the symbol of life; we learn that a place was found for it in all of the ancient forms of religious worship and today light is the medium by which men pay their homage not only to the "great white way," but in the pursuit of useful industries: Manufacturing and all classes of labor may now work with almost equal facility at night, as well as in the day.

In order to fully appreciate the many conveniences of today, it is well to look back to the times of our forefathers and make a comparison with our own times. In the busy life of the present we accept improvements as a matter of course, and in a short time forget that they have not been with us always. Especially is this true of public service improvements, and in particular of modern street lighting.

The early methods of lighting, the brush fires and torches, which were later followed by the candle and oil lamp, were the only means of street illumination until the early part of the nineteenth century. The first real advancement in the art came with the development of the gas lamp.

The adoption of the gas lamp for street lighting was slow, as it was such an innovation that the general public were suspicious and did not appreciate the wonderful improvement. The Germans seem to have been the first to make use of it. The following arguments against the illumination of streets by means of gas are reprinted from the "Koelnische Zeitung," March 28, 1816:

The illumination of streets at night by means of gas is objectionable for the following reasons:

1—From the theological standpoint. Artificial illumination is an attempt to interfere with the divine plan of the world, which has pre-ordained darkness during night time.

2—From a judicial standpoint. Those people who do not want gaslight ought not to be compelled to pay for its use.

3—From the medical standpoint. The emanations of illuminating gas are injurious. Moreover, illuminated streets would induce people to remain later out of doors, and this would lead to an increase in ailments caused by colds.

4—From the moral standpoint. The fear of darkness will vanish and drunkenness and depravity will increase.

5—From the viewpoint of the police. The horses will get frightened and the thieves emboldened.

6—From the point of view of national economics. Great sums of money will be exported to foreign countries.

7—From the point of view of the common people. The constant illumination of streets by night will rob festive illuminations of their charm.

Paris was lighted by gas in 1820. Even as late as 1833, when it was first proposed to light the streets of Philadelphia with gas, several hundreds of the leading citizens signed a petition to the council protesting against its use and the system was not installed until 1836.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

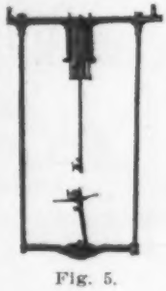


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Many of us can recall the familiar sight of the lamp lighter making his rounds each evening lighting up these open jet gas lamps (Fig. 4). The gas lamps have continued in use in some parts of the large cities until later years, and, in fact, it was only recently that the last of these lamps were replaced in Boston with a modern electric system.

The type of electric lamp which first came into general use for street lighting was the old open arc (Fig. 5). This was in 1877. The improved type (Fig. 6) was the monarch of street lights until the invention of the enclosed carbon arc lamp in 1894. The maintenance cost of the open arc lamp was high, as a single trim would burn only from eight to ten hours. Some of these lamps were arranged with two sets

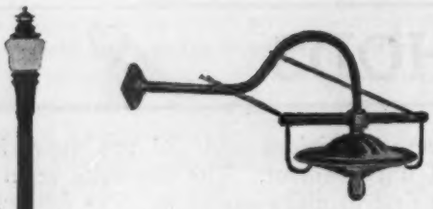


Fig. 10.

Fig. 11.

Fig. 9.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

of carbons, when one set burned out the other set would automatically start up. These old open arc lamps gained the reputation of giving 2000 candlepower, as at the time they were brought out there were no photometers which would accurately record their light.

A story is told of an enthusiastic salesman who claimed 8000 candlepower for his lamp, explaining that if the lamp were installed at the street intersection there would be 2000 candlepower shining in the four directions, or a total of 8000 candlepower. Later tests show the open arc as giving a maximum of about 1200 candlepower, but the light was unsteady, being affected by the wind and rain.

The enclosed arc lamp (Fig. 7) was of much less candlepower than the open arc, or about 600 candlepower. However, the light was fairly steady, as the inner enclosing globe protected the arc from air cur-

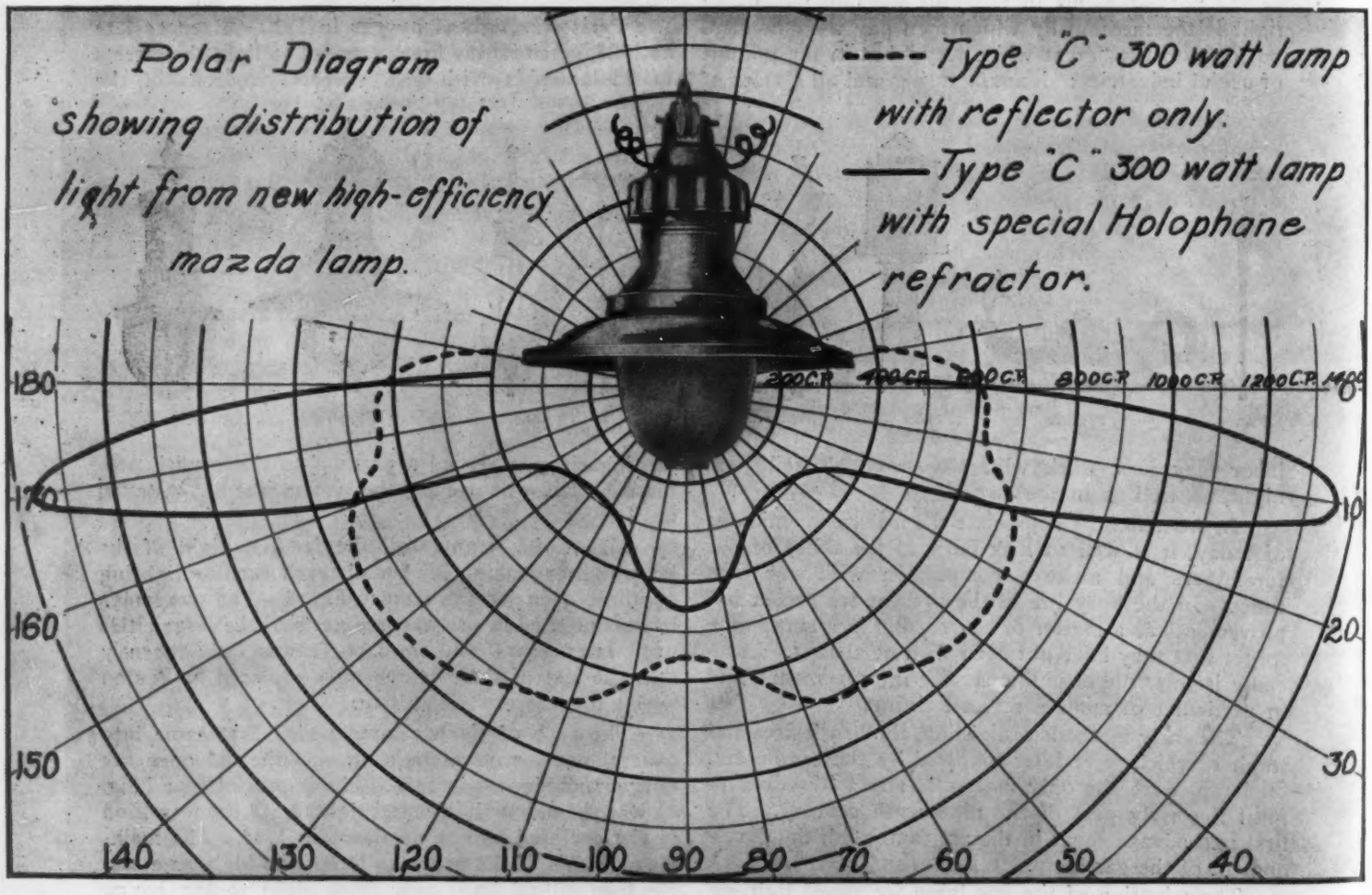


Fig. 17.

rents and the weather, also increased the hours of burning on one trim to seventy or eighty hours. This lamp continued as the favorite high candlepower unit for street lighting for some ten years, but in the last few years it was superseded by the magnetite luminous arc lamp (Fig. 8).

The magnetite lamp is peculiarly adapted to street lighting, as its maximum candlepower (about 700 candlepower) occurs at 10 degrees below the horizontal and thus sends more light to the distant points. A very even distribution of light is obtained by a proper placing of these lamps. One of the electrodes is a solid copper lug, the other a five-eighths inch iron tube filled with powdered magnetite. The copper electrode has a life of from 4000 to 6000 hours, the magnetite electrode lasts from 175 to 200 hours. The quality of light is very white and illuminated objects are given

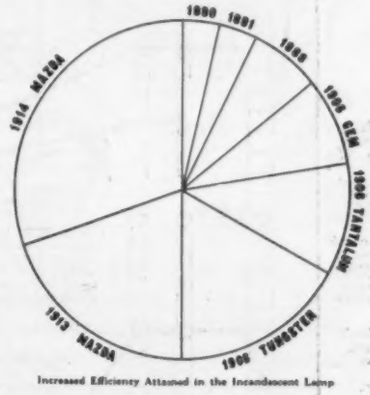


Fig. 18.

their true color values. The usual method of installation is to suspend this lamp over the street intersections; however, an ornamental standard (Fig. 9) has been designed with the lamp mechanism as a part of the post, which lends itself nicely to the lighting of more congested districts.

While the arc lamps, until recently, have been the only large units for street lighting, the incandescent lamp has been used in many places where it was found advantageous to install smaller units placed at short intervals. The fifty-five volt sixteen candlepower carbon filament lamp arranged forty in series, and supplied from a 2200 volt line, was one of the early systems. These lamps would be placed one on each pole, or every other pole, using a goose-neck bracket similar to Fig. 10.

With the advent of the tungsten lamp, an improved bracket was brought out, having a radial wave reflector (Fig. 11), by which the light was increased in the useful direction.

One of the first thoroughfares to be lighted with ornamental posts was Broadway, Los Angeles. These lights were installed in July, 1905, and mark the beginning of a form of street lighting which has become very popular. Fig. 12, 13, 14, 15, show some of the more usual types of ornamental posts.

The modern arc lamp shows no special gain in actual efficiency (watts per candlepower) over the old-time lamp, but the incandescent lamp, beginning with an efficiency of about six watts per candlepower has been improved until now the type "C" Mazda operates at one-half watt per candlepower, and equals the most improved arc lamp in efficiency. This remarkable development is shown graphically in Fig. 18.

With the type "C" (gas filled) Mazda we have a street lighting unit which meets the demands of the most critical. Its light is absolutely steady, and it requires attention only when broken or burned out. As the manufacturers guarantee 1000 hours life it is safe to expect much longer operation. As the larger units are the most efficient it will probably be used with the single light post, one of the latest design of which is shown in Fig. 16.

The distribution of light around the incandescent lamp is approximately uniform. For street lighting the best results are obtained with the maximum intensity at ten degrees below the horizontal. This result has been obtained by the development of a special Holophane refracting globe which highest authorities claim marks the greatest improvement in street lighting since the advent of the wire-drawn tungsten filament. In Fig. 17 is shown one of the latest types of pendant fixtures designed for use with the long-neck type "C" Mazdas. The polar diagram shows how the special Holophane globe takes the light which is not needed in the vertical directions and more than doubles the useful light at ten degrees below the horizontal.

In the foregoing has been outlined briefly the methods of street lighting of yesterday and today, what the future will bring forth, it would be foolish for the wisest to prophesy.

THE MEETING OF CONVENTIONS AT SAN FRANCISCO.

More than three hundred state, national and international conventions have decided to hold their 1915 meetings in or near San Francisco. These convention meetings are arranged through the Exposition Bureau of Conventions and Societies, and as this Bureau is in touch with many societies whose meetings are to take place between now and February 20th, doubtless several more conventions will be secured.

The first convention of the Exposition series will meet of February 17, 1915, and a constant session of conventions will be held from that date until the close of the Exposition.

It is a significant fact that since the war in Europe began, state and national conventions have turned more and more to San Francisco as the logical place for their 1915 sessions. During the last fifteen days in August, fifteen conventions decided to meet here in 1915, and during September even a better record was made, as thirty-seven conventions decided to meet here. These conventions were secured in such widely distributed cities as St. Paul, Salt Lake City, Detroit, Helena, New York, San Francisco, Newburgh, Minneapolis, Atlantic City, Milwaukee and Boston. All this indicates faith in the Exposition.

A great many people in our own country who yearly travel to Europe are now able to do what they have long had in mind to do, namely, see their own country and indications are that many visitors who yearly go to Europe will visit California instead. The conventions will bring many of them here.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

F Street Lighting.

BY L. M. KLAUBER.

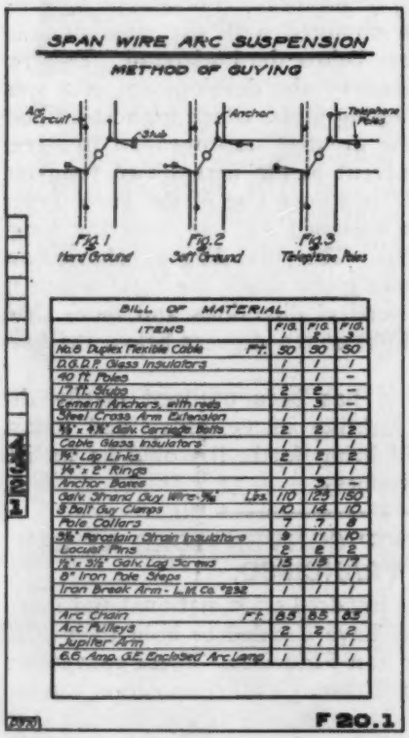
[Continued.]

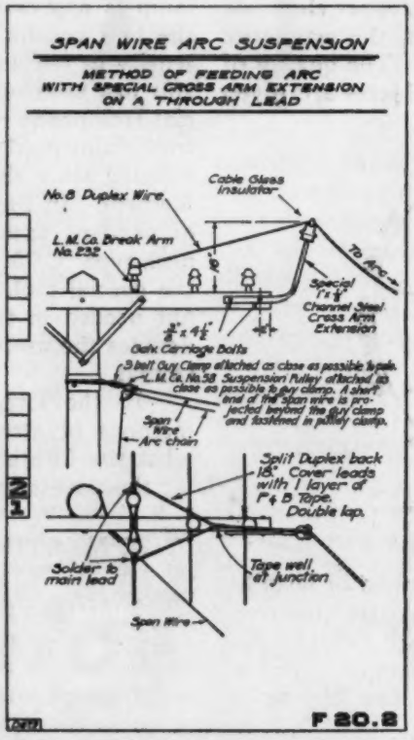
Section F contains the following information:

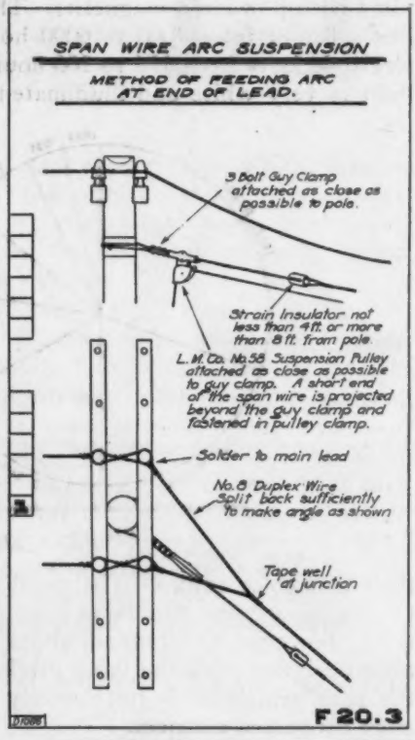
F 10 Renewals for Street Lights.
F 20 Hanging of Arcs.
F 30 Switching Schedule.
F 40 Hanging of Incandescents.

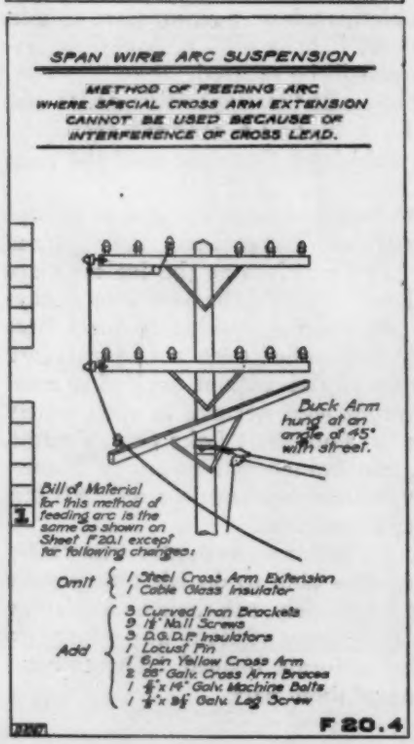
F 10: Renewals for Street Lights.—The information contained in this division being of local application only, is not here repeated. Globe and lamp sizes and ratings are listed for series incandescent and ornamental block lights in the various municipalities served, thus informing patrolmen of the proper apparatus to use in making renewals.

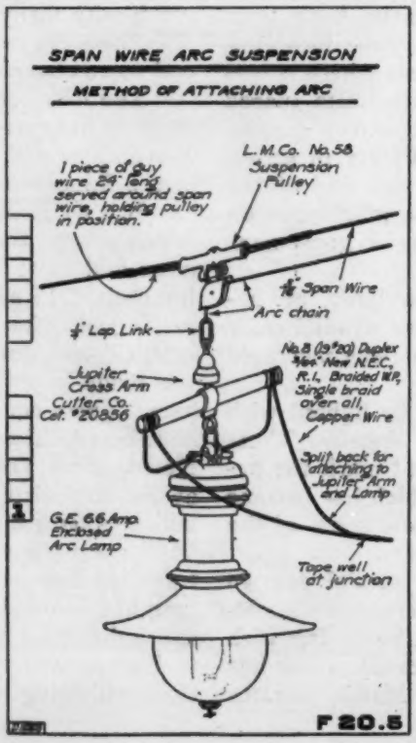
F 20: Hanging of Arcs.—The matter contained in this division is fully explained by the cuts here re-

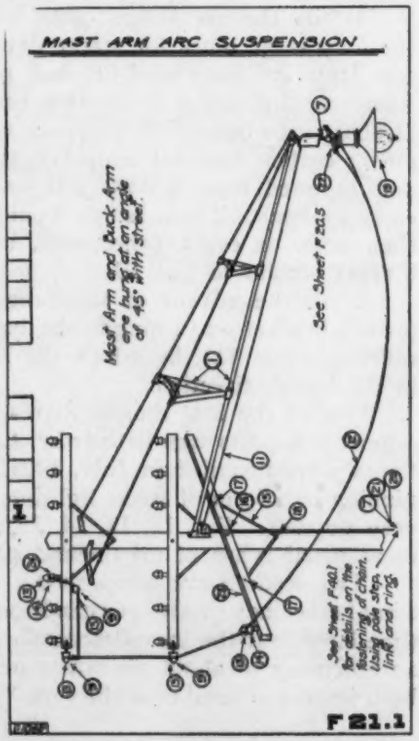

SPAN WIRE ARC SUSPENSION
METHOD OF GUYING
Arc Circuit
Stub
Anchor
Telephone Poles
Fig. 1 Hard Ground
Fig. 2 Soft Ground
Fig. 3 Telephone Poles
BILL OF MATERIAL
ITEMS
Fig. 1
Fig. 2
Fig. 3
No. 6 Duplex Flexible Cable Ft. 50 50 50
D.G.D.P. Glass Insulators 1 1 1
40 Ft. Poles 1 1 --
17 Ft. Stubs 2 2 --
Cement Anchors, with rods 1 3 --
Steel Cross Arm Extension 1 1 1
5/8 x 9" Galv. Carriage Bolts 2 2 2
Cable Glass Insulators 1 1 1
1/4" Lap Links 2 2 2
1/4" x 2" Rings 1 1 1
Anchor Bolts 1 3 --
Galv. Strand Guy Wire 3/8" Lbs. 110 129 150
3 Bolt Guy Clamps 10 14 10
Pole Collars 7 7 8
5 1/2" Porcelain Strain Insulators 9 11 10
Locust Pins 2 2 2
1/2" x 3 1/2" Galv. Lag Screws 15 19 17
8" Iron Pole Steps 1 1 1
Iron Break Arm - L.M. Co. #232 1 1 1
Arc Chain Ft. 85 85 85
Arc Pulleys 2 2 2
Jupiter Arm 1 1 1
6.6 Amp. G.E. Enclosed Arc Lamp 1 1 1
F 20.1

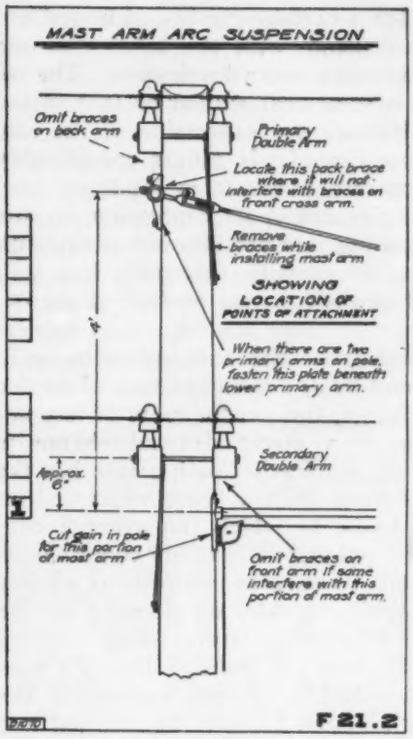

SPAN WIRE ARC SUSPENSION
METHOD OF FEEDING ARC WITH SPECIAL CROSS ARM EXTENSION ON A THROUGH LEAD
No. 6 Duplex Wire
Cable Glass Insulator
L.M. Co. Break Arm No. 232
To Arc
Special 1" x 4" Channel Steel Cross Arm Extension
5/8" x 9 1/2"
Galv. Carriage Bolts
3 Bolt Guy Clamp attached as close as possible to pole.
L.M. Co. No. 58 Suspension Pulley attached as close as possible to guy clamp. A short end of the span wire is projected beyond the guy clamp and fastened in pulley clamp.
Span Wire
Arc chain
Split Duplex back 18". Cover leads with 1 layer of F & B Tape. Double lap.
Solder to main lead
Tape well at junction
Span Wire
F 20.2

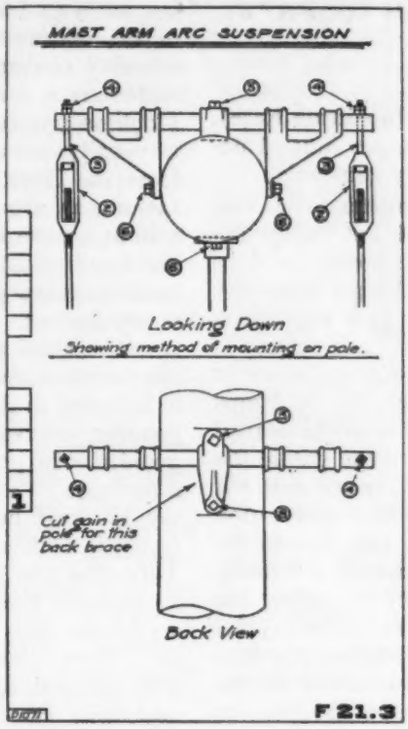

SPAN WIRE ARC SUSPENSION
METHOD OF FEEDING ARC AT END OF LEAD.
3 Bolt Guy Clamp attached as close as possible to pole.
Strain Insulator not less than 4 ft. or more than 8 ft. from pole.
L.M. Co. No. 58 Suspension Pulley attached as close as possible to guy clamp. A short end of the span wire is projected beyond the guy clamp and fastened in pulley clamp.
Solder to main lead
No. 6 Duplex Wire Split back sufficiently to make angle as shown
Tape well at junction
F 20.3

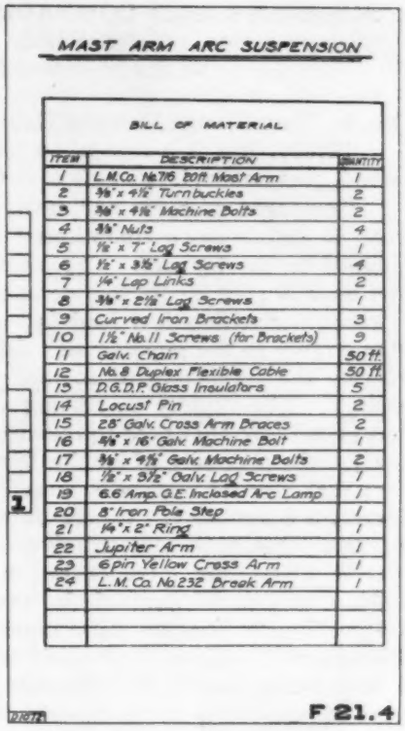

SPAN WIRE ARC SUSPENSION
METHOD OF FEEDING ARC WHERE SPECIAL CROSS ARM EXTENSION CANNOT BE USED BECAUSE OF INTERFERENCE OF CROSS LEAD.
Buck Arm hung at an angle of 45° with street.
Bill of Material for this method of feeding arc is the same as shown on Sheet F 20.1 except for following changes:
Omit 1 Steel Cross Arm Extension
1 Cable Glass Insulator
Add 3 Curved Iron Brackets
9 1/2" No. 11 Screws
3 D.G.D.P. Insulators
1 Locust Pin
1 6 pin Yellow Cross Arm
2 58" Galv. Cross Arm Braces
1 5/8" x 14" Galv. Machine Bolts
1 1/2" x 3 1/2" Galv. Lag Screw
F 20.4


SPAN WIRE ARC SUSPENSION
METHOD OF ATTACHING ARC
1 piece of guy wire 24" long served around span wire, holding pulley in position.
L.M. Co. No. 58 Suspension Pulley
1/2" Span Wire
Arc chain
1/4" Lap Link
Jupiter Cross Arm Cutler Co. Cat. #20856
No. 8 (19 #20) Duplex 1/16" New N.E.C., R.I., Braided W.P., Single braid over all, Copper Wire
Split back for attaching to Jupiter Arm and Lamp
G.E. 6.6 Amp. Enclosed Arc Lamp
Tape well at junction
F 20.5


MAST ARM ARC SUSPENSION
Mast Arm and Buck Arm are hung at an angle of 45° with street.
See Sheet F 20.5
See Sheet F 40.1 for details on the fastening of chain, Using pole step, link and ring.
F 21.1


MAST ARM ARC SUSPENSION
Omit braces on back arm
Primary Double Arm
Locate this back brace where it will not interfere with braces on front cross arm.
Remove braces while installing mast arm
SHOWING LOCATION OF POINTS OF ATTACHMENT
When there are two primary arms on pole, fasten this plate beneath lower primary arm.
Secondary Double Arm
Approx. 6'
Cut gain in pole for this portion of mast arm
Omit braces on front arm if same interfere with this portion of mast arm.
F 21.2


MAST ARM ARC SUSPENSION
Looking Down
Showing method of mounting on pole.
Cut gain in pole for this back brace
Back View
F 21.3


MAST ARM ARC SUSPENSION
BILL OF MATERIAL
ITEM | DESCRIPTION | QUANTITY
1 | L.M.Co. No.716 20ft. Mast Arm | 1
2 | 5/8" x 4 1/2" Turnbuckles | 2
3 | 5/8" x 4 1/2" Machine Bolts | 2
4 | 5/8" Nuts | 4
5 | 1/2" x 7" Lag Screws | 1
6 | 1/2" x 3 1/2" Lag Screws | 4
7 | 1/4" Lap Links | 2
8 | 3/8" x 2 1/2" Lag Screws | 1
9 | Curved Iron Brackets | 3
10 | 1 1/2" No.11 Screws (for Brackets) | 9
11 | Galv. Chain | 50 ft.
12 | No.8 Duplex Flexible Cable | 50 ft.
13 | D.G.D.P. Glass Insulators | 5
14 | Locust Pin | 2
15 | 2.8' Galv. Cross Arm Braces | 2
16 | 5/8" x 16" Galv. Machine Bolt | 1
17 | 5/8" x 4 1/2" Galv. Machine Bolts | 2
18 | 1/2" x 3 1/2" Galv. Lag Screws | 1
19 | 6.6 Amp. G.E. Inclosed Arc Lamp | 1
20 | 8' Iron Pole Step | 1
21 | 1/4" x 2" Ring | 1
22 | Jupiter Arm | 1
23 | 6 pin Yellow Cross Arm | 1
24 | L.M. Co. No.232 Break Arm | 1
F 21.4

produced. Sheets F 20.1 to F 20.5, inclusive, cover span suspension, while F 21.1 to F 21.4 cover mast arm suspension. As the present series arc circuits contain an average of over one hundred lamps each, particular attention has been given to the clearances between these and other circuits. Duplex wire drops to the lamps have resulted in safer construction and better appearance.

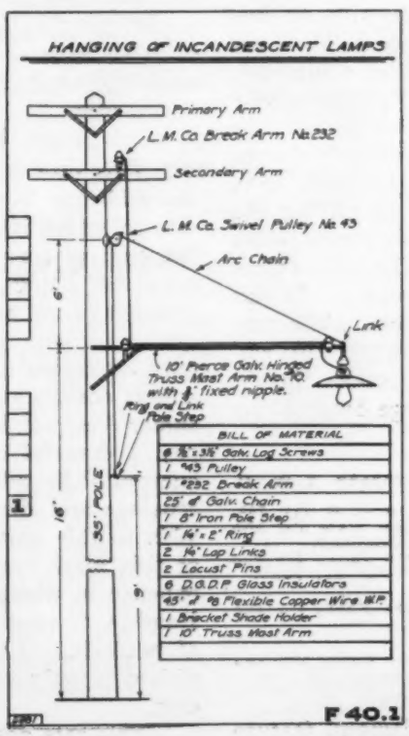
F 40: Hanging of Incandescent Lamps.—This information follows the same lines as that contained in F 20, two types of suspension being employed. Not so much care has been taken with insulation in the series incandescent circuit, for, where they are operated from the arc circuits, the former are divided into small groups and type S. L. transformers are used. This permits running the incandescent circuits on the secondary arm, and would prevent outages in the arc circuit due to a break in the less rugged incandescent apparatus. The 10 ft. mast arm has been found useful in carrying the light out beyond the trees, while the hinge feature permits renewals without difficulty.

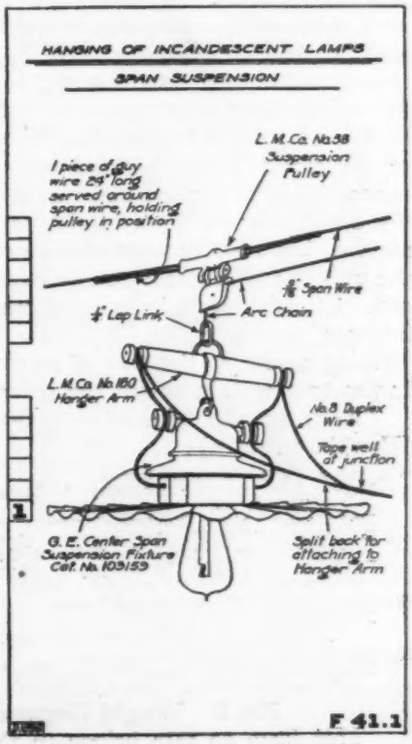
[To be continued.]

F 30: Switching Schedule.

Time for Switching Street Lights or Signs—Hours for Setting Time Switches.

January	1st	to 15th—	5:10 p. m.
January	16th	to 31st—	5:20 p. m.
February	1st	to 15th—	5:35 p. m.
February	16th	to 28th—	5:50 p. m.
March	1st	to 15th—	6:00 p. m.
March	16th	to 31st—	6:15 p. m.
April	1st	to 15th—	6:25 p. m.
April	16th	to 30th—	6:35 p. m.
May	1st	to 15th—	6:45 p. m.
May	16th	to 31st—	6:55 p. m.
June	1st	to 15th—	7:05 p. m.
June	16th	to 30th—	7:10 p. m.
July	1st	to 15th—	7:10 p. m.
July	16th	to 31st—	7:05 p. m.
August	1st	to 15th—	6:55 p. m.
August	16th	to 31st—	6:35 p. m.
September	1st	to 15th—	6:15 p. m.
September	16th	to 30th—	5:55 p. m.
October	1st	to 15th—	5:35 p. m.
October	16th	to 31st—	5:20 p. m.
November	1st	to 15th—	5:05 p. m.
November	16th	to 30th—	4:55 p. m.
December	1st	to 15th—	4:55 p. m.
December	16th	to 31st—	5:00 p. m.




HANGING OF INCANDESCENT LAMPS
SPAN SUSPENSION
L.M. Co. No.38 Suspension Pulley
1 piece of guy wire 24" long served around span wire, holding pulley in position
1/8" Span Wire
1/4" Lap Link
Arc Chain
L.M. Co. No.160 Hanger Arm
No.8 Duplex Wire
Tape well at junction
G. E. Center Span Suspension Fixture Cat. No. 109159
Split back for attaching to Hanger Arm
F 41.1

A RESUME AND COMPARISON OF RATE THEORIES.

BY STACY HAMILTON.

[Concluded.]

No. 4. Two-Charge Demand Rate (Hopkinson Rate).

Briefly, this is a rate of so much per unit of demand, plus so much per unit of energy consumed.

Compared with flat and straight meter rates, this rate is rather more complicated and not easily explained to the layman. The average consumer does not usually take kindly to a demand charge, especially a consumer with a low load factor. This attitude is due largely to the popular idea that electric service is merely the furnishing of so many kilowatt hours of energy. The rapidly increasing efficiency of lamps has rather forcibly called to the attention of the central station the necessity of emphasizing to the public the fact that electric service is largely a service and not merely a commodity. Where water power generation predominates, as is almost universally the case on the Pacific Coast, the mere energy furnished is usually only a very small part of the cost of rendering the service, and it becomes more important every day for the general public to be properly informed of this fact. The common use of the kilowatt hour alone as the unit of service is largely to blame for the present public attitude regarding demand charges in connection with a low energy charge.

This rate is more theoretically correct than those previously discussed, as it more closely conforms to the cost of rendering the service under varying conditions of operation. In the case of large consumers it also has a distinct advantage, from the value of service standpoint, as it automatically conforms to the consumer's cost of furnishing the required service by means of an independent plant. If such a consumer has long hour use of his equipment, his unit cost with an independent plant will naturally be comparatively low, and the central station's rate, when applied to such operating conditions, must necessarily be low also in order to compete. On the other hand, if the consumer has only a short hour need of his equipment, his independent plant unit cost will be comparatively high. As provided under the Hopkinson system, the central station's rate for such a condition will also be proportionately higher, and rightly so, not only from the standpoint of higher unit cost of furnishing the service, but also because the service is worth more per unit to the consumer on account of his own higher cost of furnishing it from some other source. In this instance, therefore, the Hopkinson system, while conforming nearer to the cost of service theory, also embodies to a certain extent the value of service theory.

References to opinions on two-charge demand rate (Hopkinson rates):

Wisconsin Railroad Commission.
Milwaukee Electric Railway & Light Company, 6 W. R. C. R. 64, 68.
Red Cedar Valley Electric Company, 6 W. R. C. R. 717, 758.
Decision 8/20/1912, Establishing Hopkinson Rate for the Milwaukee Electric Railway & Light Company.
Decision 11/4/1913, Establishing Hopkinson Rates for the Chippewa Valley Railway, Light & Power Company.

Montana Public Service Commission.
Decision 11/3/1913, Establishing Hopkinson Rates for the Helena Light & Railway Company.

Illinois Public Utilities Commission.
Decision 5/6/1914, Establishing Hopkinson Rates for the Western United Gas & Electric Company.

No. 5. Wright Demand Rate.

This form or rate brings in the demand feature of the charge by a comparatively high primary rate per kilowatt hour for a certain number of hours' use of the consumer's demand, with the balance of the monthly consumption at a much lower rate. The resultant rate curve is somewhat similar to that of the Hopkinson rate, although the expression of the rate is usually more complicated. It differs considerably from the Hopkinson rate, however, in the lower load factors, as, from the nature of its expression, it puts a limit on the maximum rate per kilowatt hour, with the result that consumers with extremely low load factors escape part of their proper portion of the demand charges.

The chief advantage of this rate seems to be in the fact that the stand-by or demand feature of service is included in the charge, and yet the more or less unpopular expression of a direct demand charge is avoided. In practical application such a rate has the advantage of all charges therein being expressed on the kilowatt hour basis, to which the average consumer is accustomed and can more easily comprehend. This rate can hardly be said to conform as closely to cost as the Hopkinson rate, on account of the maximum limit per kilowatt hour previously referred to. There is usually, however, more or less of a popular demand for a schedule directly expressing the maximum rate per kilowatt hour to be charged and considerable pressure brought to bear to keep down the maximum. Such maximum rates are sometimes embodied in franchises, and often prescribed in rate-fixing ordinances of municipalities.

The Hopkinson two-charge rate, limited by such a maximum per kilowatt hour, is, in effect, converted into a Wright demand rate.

The latter has been recommended or ordered in a number of cases by the

Wisconsin Railroad Commission.
Decision 11/18/1913, Establishing Wright Demand Rates for the Milwaukee Gas and Electric Company.
Decision 4/6/1914, Establishing Wright Demand Rates for the Monroe Electric Company.

Also **New York Public Service Commission, 2nd District.**
Decision 4/2/1913, Recommending Wright Demand Rates for the Buffalo General Electric Company.

California Railroad Commission.
Decision 7/29/1913, Establishing Wright Demand Rates for the Tuolumne County Electric Power & Light Company.

No. 6. Doherty Rate.

This rate is similar to the Hopkinson rate, with the addition, however, of what is called a customer charge, which is intended to distinguish that portion of the cost of service which is directly caused by the consumer being connected to the company's system, whether or not any demand is made on the company's system or any energy is used. The chief, if not only, objection to this form of rate is its tendency to appear complicated to the layman. The average consumer does not favor the idea of being called upon to pay a demand charge, especially when he uses no energy. The addition of the customer charge as a separate and distinct item from the demand charge adds to this objection. The successful use of a rate of this kind usually requires time and more or less expense in educating consumers to the fact that the stand-by or readiness to serve feature is the chief cost of rendering service, and that the actual energy furnished is only of secondary importance in the total cost.

This rate possibly conforms more closely to individual cost of service than any other general rate

which has been offered up to the present time, as it directly itemizes the three general elements of the cost of serving the individual consumer. The customer charge is most prominent and of most importance in a rate for residence service. An analysis of the cost of serving this class of consumer indicates that the customer costs are a very prominent part of the total cost and will become more so as lamp efficiency increases. In the total cost of serving large consumers, however, the customer charge, being practically constant for all sizes of consumers, becomes relatively insignificant, and the value of a separate and distinct customer charge in such cases is not so important as in the case of residences and other small consumers.

No. 7. Guarantee Rate.

This form of rate may or may not include the demand element. Its usual form is a decreasing scale of charges per unit of either demand or energy, or both, with a corresponding increase in the minimum revenue guaranteed by the consumer. The successful application of such a rate depends largely upon the policy adopted in applying the guarantee. If the consumer is properly assisted by the central station in determining the guarantee most advantageous to his load over a period which will cover all probable variations of the consumer's operating conditions, such a rate will work out quite satisfactorily. If, however, the consumer is allowed to choose a guarantee which is later found to result in a higher charge than he might have obtained under a higher or lower guarantee, he is quite often apt to lay the blame at the door of the company, and in any event he will be more or less dissatisfied. Such conditions will be measured by the extent to which the company is willing to go in making readjustments of the consumer's guarantee. Perhaps the chief disadvantage of this form of rate is the necessity of frequently making such adjustments. A rate of this kind is quite apt to result in discrimination between individual consumers, causing more or less dissatisfaction and criticism from the public and the regulating authorities.

The chief advantage of this rate lies in the simple form in which it may be expressed, and, consequently, easily understood by the consumer, this basis of differential in unit charges being rather common in other lines of business.

No. 8. Consumers' Output Rate.

This form of rate represents a charge for electric service, usually for power, based on the output of the product which the consumer is manufacturing. Unless the consumer's output can be quite definitely predetermined for the entire term of the contract under which this rate is given, and unless the efficiency with which the consumer manufactures his product can be sufficiently guaranteed to the supplying central station, such a rate is not likely to be at all satisfactory to the latter. This form of rate imposes on the central station whatever risk and uncertainty may exist in maintaining the efficiency of the consumer's plant and the demand for his product, and this, usually, under conditions which are entirely out of the control of the central station. For these same reasons, such a form of rate is, of course, quite satisfactory from the consumer's standpoint.

It may, however, be used to advantage under conditions where a new field of electric service is being developed, and the prospective consumer is not willing to accept the risk and uncertainty of the effect of the new service on his costs.

No. 9. Off-Peak Rate.

The rates previously mentioned usually apply to general service; that is, unlimited 24-hour service. As the average central station seldom enjoys a yearly load factor better than 40 to 50 per cent, it is quite evident that its system of rates should give all encouragement possible to the development of off-peak loads. Off-peak concessions are quite often expressed as entirely separate and distinct schedules, while in other cases they are covered by some form of discount or other form of differential applied to one or more of the company's standard rates for 24-hour service.

The justification of the off-peak rate depends largely upon the company's ability to know that the load is a bona fide off-peak load. At the present stage of meter development, this assurance is rather costly, and, in case of small loads, it is often questionable whether the cost and operation of the necessary meter equipment is justified. Where conditions are such as to justify the installation of a separate system of mains and services which may be controlled from the central station, the individual meter expense can, of course, be avoided.

Off-peak concessions in charge are undoubtedly destined to be an important feature in the rate systems of central stations. This is assured by the rapidly increasing use of electric vehicles, irrigation, electric furnaces and other loads which can readily be made to conform to the off-peak conditions required by the supplying company.

Recognition of the equity of off-peak rates is found in the following:

Massachusetts Board of Gas and Electric Light Commissioners.
Edison Electric Illuminating Company of Boston, Mass. G. & E. R. 1909—46.

New York Public Service Commission, First District.
Report 1910, Vol. 4, page 14.

New York Public Service Commission, Second District.
Decision 4/2/1913, Recommending Off-Peak Rates for Buffalo General Electric Company.

Wisconsin Railroad Commission.
Decision 8/20/1912, Establishing Off-Peak Rates for the Milwaukee Electric Railway & Light Company.
Decision 4/6/1914, Approving Off-Peak Rates for the Monroe Electric Company.

Illinois Public Utilities Commission.
Decision 5/6-1914, Approving Off-Peak Rates for the Western United Gas & Electric Company.

Choice of Rate Form.

In the existing rate systems, various combinations of the bast forms of rates will be found. Just which form of rate it is found advisable to use often depends on local conditions, and, more or less, on the precedent established by the central station's previous system of rates.

Differentials.

In most of the above-mentioned rates there will often be found a scale of differentials for quantity of consumption or demand, or both. Even power factor is sometimes recognized by basing the demand charge on the k.v.a. unit, rather than the kw., and in nearly all schedules, for residence lighting at least, a discount is allowed for prompt payment.

The Wisconsin and California Commissions have recognized the equity of differentials for quantity in consumption and demand charges in the following:

Wisconsin Railroad Commission.
Jefferson Municipal Electric Light and Water Plant, 1910-5-W. R. C. R.-585.
Decision 8/20/1912, Establishing Rates with Differentials for Quantity of Demand and Consumption for the Milwaukee Electric Railway and Light Company.

California Railroad Commission.
Decision in Case 297, Town of Willets vs. Willets Water and Power Company.

The form of differential for quantity of either consumption or demand is usually found in a scale of discounts or rates per unit expressed in either the step form or block form. The latter is the most desirable, as it does away with the inconsistent feature of the step scale of differentials which results in a greater charge being made for a smaller quantity at the point where the step changes to the next lower rate or discount. The block form of differential has been advocated in numerous instances by the Wisconsin Railroad Commission, and while it is perhaps a little more complicated for the layman to compute, it is quite simple in expression, and if properly worded, can cause no confusion or misunderstanding.

Determination of Demand.

In the application of demand rates, the determination of the demand is an important detail. Various methods are used, usually one of the following:

1. Actual measurement by permanently installed demand meter.
2. Measurement by periodical test.
3. Estimate based on investigation of operating conditions.
4. Arbitrary rating based on a percentage of the connected load.
5. Arbitrary rating based on floor area.
6. Arbitrary rating based on assessed value of premises.

The first method, on account of the meter expense involved, is necessarily limited to large installations. Where the size of the load does not warrant a permanent demand meter, a periodical test may be made during the probable peak load of the installation, as indicated by the operating conditions. For the smaller power loads, the third and fourth methods are often used. For the large majority of lighting loads, the fourth method seems to be the most widely used, and has been accepted by the Wisconsin Railroad Commission and the New Jersey Board of Public Utility Commissioners.

Wisconsin Railroad Commission.
Ripon Light and Water Company, 1910. 5-W. R. C. R.-36.
Red Cedar Valley Electric Company, 1911. 6-W. R. C. R.-717-762.
Decision 8/20/1912, Establishing Demand Ratings for Milwaukee Electric Railway and Light Company.
Decision 11/4/1913, Establishing Demand Ratings for Chippewa Valley Railway, Light and Power Company.

New Jersey Board of Public Utility Commissioners.
Decision 5/19/1913, Establishing Demand Ratings for the Public Service Electric Company.

Floor area has been used to a limited extent. Good examples of this form of demand basis are given in the rates of the Duquesne Light Company, Pittsburg; the Hydro-Electric Commission of the Province of Ontario; and the Suburban Electric Light & Power Company, St. Louis.

The assessed value of the premises has been used as a basis for the demand charge by the City of Sheffield, England.

As previously stated, the connected load basis is perhaps the most widely used at the present time, and will give a fairly satisfactory basis for the demand rating if applied subject to correction by actual test or measurement in those individual cases where the arbitrary percentage of the connected load is manifestly working a serious injustice to the consumer. The chief objection to it, especially for residence lighting, is that it tends to penalize the use of convenience lights. This may be minimized, however, by a proper classification of the lamps used. The advantages claimed for floor area as a demand basis are that it puts no penalty on convenience lights, and is not subject to the changes that are inherent with the connected load. It also protects the company's revenue, to a certain extent, against reduction due to increases in lamp efficiency. For the same reasons, the assessed value of the premises has, at least in one instance, been used as the demand basis.

Minimum Charges.

The minimum charge of a central station, especially for residence lighting, has been a source of considerable discussion and criticism in almost every community. It has been quite generally recognized by various commissions and courts that a minimum charge within reasonable limits is justifiable.

Supreme Court of Kansas.
Cunningham et al. vs. City of Iola et al., 119 Pacific Reporter, 317.

Massachusetts Board of Gas and Electric Light Commissioners.
Edison Electric Illuminating Company of Boston, Mass. Massachusetts Gas & E. R. 1910—40-41-42.
North Adams Gas Light Company. Massachusetts Gas & E. R. 1912—22.

Missouri Supreme Court.
State ex rel. vs. Sedalia Gas Light Company, 34 Mo. Appl. 501.

New Jersey Board of Public Utilities.
Memo. in re. Minimum Monthly Charge, N. J. B. P. U.-1/16/1912.
Ocean City Gas Light Company, N. J. B. P. U., 7/19/1912.

New York Supreme Court.
Gould vs. Edison Electric Illuminating Company of New York, 60 N. Y. Supplement, 559.

Ohio.
Ohio Laws, 1911. No. 325, Sec. 19.

Tennessee.
Tennessee Chancery Case 8368.

Washington Public Service Commission.
Seattle Light Company, W. P. S. C. No. 683—11/16/1912.

Wisconsin Railroad Commission.
Appl. Lancaster Electric Light Company, 1910, 6 W. R. C. R. 53-57-59.
Appl. Greenwood Municipal Light Plant, 1910, 6 W. R. C. R. 60-61-62-63.
Appl. Bloomer Electric Light Plant, 1911, 6 W. R. C. R. 506-517.
City of Manitowoc vs. Manitowoc Electric Light Company, 1910, 5 W. R. C. R. 360-389-390.
City of Ripon vs. Ripon Light and Water Company, 1910, 5 W. R. C. R. 1-41.

There seems to be considerable difference of opinion, however, as to just what constitutes a reasonable minimum charge. The minimum charge of most central stations is intended to cover the minimum cost of serving a residence consumer, considering all items entering into such cost, including customer charges and demand charges. If such cost is to be taken as the basis, an analysis of a company's expenses, both capital and operating, will no doubt justify a minimum charge of at least $1.00 per month. In practice, however, the minimum charge is often arbitrarily determined by local conditions, especially where direct competition exists, and whatever losses are caused in rendering service at a minimum charge of less than $1.00 are absorbed by the rate charged those consumers whose monthly consumption runs over the minimum charge, or by some other class of consumers.

The popular objection to paying a minimum charge, as well as the frequent criticism of the high residence rates per k.w.h. as compared with com-

mercial lighting rates and power rates per k.w.h. are, to a large extent, due to the long established practice of basing electric charges solely on the kilowatt hour unit. This has naturally resulted in creating the general impression that the company is merely selling a commodity of so many kilowatt hours of electric energy. Looking at it from this standpoint, the layman quite naturally comes to the conclusion that when he uses little or no energy during the month, the company has not right to expect him to pay the minimum charge of 50c, 75c or $1,00, whatever it may be. For the same reason, the standby charge of so much per kilowatt of demand in addition to an energy charge, as expressed in the Hopkinson rate, or Dorothy rate, comes up for criticism, and even intelligent business men are frequently heard criticising this so-called standby charge as an unreasonable extortion, robbery or some such flattering term, when it is merely the expression of the rate which has aroused their ire.

A detailed analysis of the cost of serving the average residence consumer of almost any central station on the Pacific Coast, where water power is largely prevalent, will show that the energy actually consumed is only a very small factor in the total cost of rendering the service, and any system of rates for this class of load which, in its expression, will bring out more clearly that electric lighting, heating, power, etc., is, first of all, a service rather than a commodity, will undoubtedly have a tendency to turn popular opinion in the right direction.

A very large percentage of the total cost of serving the individual residence consumer is composed of customer expenses and demand expenses, and, as the average residence load factor is usually rather low, from 10 to 20 per cent, it naturally follows that the cost of serving such a consumer is quite high per kilowatt hour, and makes a very unfavorable comparison with the low rates per kilowatt hour charged for the higher load factor commercial lighting and power consumption. It is rather hard for even the average business man to understand how a central station can justify a residence rate of from 6 to 10 cents or even higher, and at the same time serve commercial lighting and large power users at rates down as low as one cent, the energy consumed by both classes of consumers being manufactured by the same machinery. The average man in business, accustomed as he often is, to turning over his capital two to four times in one year, does not always appreciate the position of the central station, which can not expect to turn over its investment more than once in eight or ten years. Under the latter condition, the standby or investment feature of the service is decidedly a large factor in the cost, and the commodity feature of the energy furnished is a comparatively small factor, especially in the case of water power generation. Hence the importance and justification of minimum and service or standby charges for electric service.

While local conditions will continue to have more or less influence on the basis of and form of the central station's system of charges, it is highly desirable that uniformity in the form of rate schedules be attained, as far as possible, by a universal adoption of the best of the various rate theories and schedule forms now in use, and the elimination of the balance.

DISCUSSION OF RATE THEORIES.

(These are stenographic reports of three illuminating discussions on Mr. Hamilton's paper, before the Northwest Electric Light & Power Association. —The Editor.)

F. S. Burroughs (Chief Engineer of Washington Public Service Commission): I saw this paper for the first time today, and the question of rates is one that I believe should be considered seriously, one it is rather dangerous to tackle without thinking it over carefully first. The more I study the rate question, the more I think the cost of service nearly approximates the schedule of rates.

The question of value of service is too apt to mean what the patron will pay. Determining what the service is worth is harder than determining what the actual cost is. You have to convince the patron what the value is.

Practically all the expense of furnishing electric service comes under the head of "Fixed cost." All of your expense is largely made up of your investment charges and your consumer expenses. The question of output expense is relatively small. What you want to do is to increase your load factor and increase your fixed charges per unit of output. The way to do this is to diversify your load.

Mr. Hamilton said that the Pullman berth charge is a fair example of the value of service. The upper berth being the larger is an example of the cost of service. Certain of the charges must necessarily be tied up by the 16 lower berths, while the cost of 16 upper berths necessary to make the sections, have increased your sale capacity for that car, so you clearly have increased the load factor and decreased your overhead expense per unit of car service. Also there is a larger percentage of your investment can be elected to the lower berths for the reason that you have first, a car with seats in it. By putting in the upper berths you have only to charge an additional expense and, at the same time, it splits up the original cost per berth.

In regard to the form of a rate, I do not like to say much, for a number of reasons. The form of a rate depends largely upon what the public is used to. In one community you might charge one rate, in another something else. The form of a rate is largely a matter of public education.

It has always appeared to me that the steps to be taken in preparing a rate would be, first: determine those classes of expense which vary directly with the classes of consumers. For some, the meter rate way of preparing a bill, added to this interest on investment for improvements made exclusively for the consumer's benefit. For others you have to charge a stated amount per month for service; don't tell them it is a maximum charge, just tell them that it is a service charge, and then charge them for the actual electricity which he uses. That puts the company in the position or a vendor of a commodity which, of course, it is not. If you cannot get the people to accept that, have a set rate. Make a rather high initial charge and step down.

Mr Hamilton mentioned competitive business and the necessity of making low rates on account of competition. This is all right if not carried to extremes. But you must remember business is not worth getting unless you get at least the cost of service. The consumer must pay per unit of consumption a profit upon the general plant, and upon a portion of the general expense, but not necessarily as large a profit per unit of consumption as the man who only uses a few kw.-hr.

C. M. Fassett (Commissioner of Public Utilities of Spokane): When I listened to Mr. Hamilton's able paper, I was sorry that Mr. Cotton wasn't there to listen to some of Mr. Hamilton's discussion on rates. He might then have concluded that he was mistaken about the ease with which the rates for a gallon of water or a gallon of gas can be made.

[Continued on page 394.]

LOS ANGELES AQUEDUCT MISTAKES.

BY CHARLES E. WARNER.

(The startling accusations in this paper are an abstract of an address by the author before the Oregon Engineers' Club at Portland, on October 8, 1914, under the title of "Some Hitherto Unmentioned Features of the Los Angeles Aqueduct," Comment is invited.—The Editor.)

In a Los Angeles paper I recently noted an account of a sanitary investigation of the water of the Los Angeles Owens River Aqueduct by Ethel Leonard, B. S. M. D., in which it is stated that "even bacteria cannot develop in such polluted water." As chairman of the Aqueduct Investigation Board of Los Angeles, I wrote a report August 31, 1912, in which I endeavored to state conservatively such facts as the one referred to by Dr. Leonard.

The Los Angeles Aqueduct has been advertised to the world as a great public undertaking, an engineering success and a triumph of municipal enterprise. As constructed, it takes water from the Owens River in Inyo County and carries it about 240 miles due south to the San Fernando Valley at a point 24 miles north of Los Angeles.

The investigation referred to was conducted at great length by the Investigation Board and a large staff of experts. Numerous trips of inspection and months of study and examination of witnesses preceded the final conclusions arrived at. I, personally, walked 200 miles on one trip of examination.

The actual conditions found in the investigation of this great aqueduct were a shock to the friends of honest municipal operation. The men who signed the report of the Aqueduct Investigation Board were all friendly to municipal operation and hated to find what they could not in honor refuse to see.

More than thirty million dollars were spent by the taxpayers of Los Angeles for that aqueduct.

The aqueduct was not needed.

Los Angeles already owned a supply of good drinking water sufficient for one million people and only a part of the water available near Los Angeles has ever been conserved or developed for use.

The aqueduct water is fit for irrigation only, and a citizen of Los Angeles is now in court trying to prevent the water bureau officials from turning that water into the city mains.

The aqueduct was announced to the Los Angeles people in July, 1905. It was discussed in secret by a number of people for two or three years prior to that and was "sprung" at a time and in a manner to sweep people off their feet.

Certain dry lands north of Los Angeles received great benefit from the aqueduct. Large areas of these lands, amounting to thousands of acres, belonged to a few influential politicians of Los Angeles. The aqueduct scheme was originally proposed to the "inside crowd" by a former Mayor of the city. This ex-Mayor was entrusted with funds and asked to purchase large tracts of land in Owens Valley and Long Valley. When the deeds were signed, it was found that the ex-Mayor had kept for himself more than half of the land and all the cattle, about 5000 head. For reasons best known to themselves, the city officials could not compel the ex-Mayor to give up the land he had kept. This necessitated doing away with the principal storage reservoir and reduced the quantity of water about two-fifths.

The aqueduct intake is at nearly the lowest point in the Owens Valley. The water here carries nearly all the seepage, sewage and drainage of the towns and farms of the valley. From the intake to Haiwee reservoir is 60 miles of open ditch partly lined, partly unlined. A considerable number of desert animals fall into this section and drown, floating down into the big reservoir. The capacity of the ditch is 900 c. f. s., or 45,000 gal. miners' inches. Haiwee reservoir has 64,000 acre feet capacity.

Below the Haiwee reservoir the aqueduct is enclosed and has a capacity of 400 c. f. s., or 20,000 inches.

It is 135 miles from Haiwee reservoir to Fairmont reservoir and the conduit runs through desert and mountains all the way. There are a number of steel inverted siphons across canyons and many long tunnels through the mountains.

Fairmont reservoir has 7600 acre feet capacity. South of this a tunnel was driven over five miles long. Below here the conduit runs through about 40 miles of dry country with more tunnels and inverted siphons, till it reaches the San Fernando reservoirs, one of 16,000 and the other 21,000 acre feet. Below these reservoirs lie the large land holdings previously mentioned. From this point to Los Angeles only a relatively small pipe was to be installed.

The transportation of supplies for construction was a tremendous task. Twenty-eight caterpillar engines and ninety-four trail wagons were bought for this purpose and operated for several years at an estimated cost of 20 to 25 cents per ton mile. In 1910 this cost suddenly jumped to 65 cents per ton mile, the caterpillars were discarded and hundreds of mules purchased. Incidentally, eleven caterpillar engines and twelve trail wagons have never been accounted for. They cost $47,610. Our most persistent inquiries failed to elicit any information. Like the Indians' wigwam, they were just "lost."

The concrete work was extremely unfortunate, but furnished an interesting example of the practical effect of adulterants. An attempt was made to duplicate some of the concrete work of Italy, in which enters a volcanic material known by several names, one being tufa. Three quarries were opened along the general location of the aqueduct and a supposed tufa was mixed with a large portion of the cement. The best opinions indicated that the supposed tufa was in reality a clay. A Los Angeles brick manufacturer made very fine sample bricks of it. Anyway, its effect on concrete was just the same as clay. It made a good piece of work if kept moist about one month, but its set was extremely slow. In the tunnels, it had an opportunity to set and usually the tunnel concrete was good. On the desert, however, it was doomed from the start. I have photographs showing where it has crumbled like poor adobe. Some of the piers under the big steel siphons are like gypsum, soft and crumbly. I have other photographs showing where several of the concrete ribs of the aqueduct roof were kicked over by one man and shattered as they tipped over.

It is only a question of a short time when several

million dollars will have to be spent in replacing this poor concrete. Many breaks have already occurred.

A large cement plant was built for aqueduct cement. It produced less than 700,000 barrels and the net cost was $2.84 per barrel.

It seems to me that engineers today ought to try to reach outside of technicalities and consider the public effect of things. There are many things that might be done for the general benefit. There are other things that may be attempted which will be of doubtful benefit to anyone. A body of men such as yours can exert a great influence, and I am glad to be able to give you this example of some of the things to be avoided.

The State of Oregon and the entire Northwest is threatened with a mis-application of its resources. There is a general feeling that things are not right and that something must be done. Something can be done. I am working toward that end, myself. I see a great development pending in this section. We have great resources which can be made the basis of general prosperity for all who live and work here. On the other hand, no community is proof against such things as I have referred to concerning the Los Angeles aqueduct. I recommend to you the careful consideration of a definite programme for engineering development along sane but progressive lines.

U.S. GEOLOGICAL SURVEY WORK IN OREGON

As the result of laws passed by the Oregon Legislature, particularly in 1911, Oregon is just beginning to reap the benefits of a large amount of co-operative investigation made by the state and by the United States Geological Survey. The state and the survey have been spending equal amounts in the work in Oregon in accordance with these laws, and many topographic maps have been completed, stream flow measurements made and water resources investigated. The resulting maps, bulletins and statistics are of great value to all persons interested in Oregon.

Since the original topographic map bill was passed, the following sheets have been surveyed co-operatively and published: Mitchell Butte, Blalock Island, Umatilla, Eugene, Halsey, Oregon City and Boring, with a total area of about 35000 square miles. These maps are among the finest made and they are really the only one of these areas that have any claim to accuracy. They are on scales of ½ to 1 inch to the mile, and are in several colors and show every detail, even the houses. They also show accurately all elevations, and are sold for the small sum of ten cents each by the Geological Survey at Washington or by stores in Portland.

In addition to the above maps the Survey has also published during the past four or five years the Mt. Hood, Grants Pass and Crater Lake sheets, which were made out of its own funds and in addition to the co-operative work. The Survey has also issued six large lithographed maps of the upper Willamette valley on a scale of 2 inches to the mile, with five foot contours, intended primarily for drainage and development purposes. These maps are all in colors. Among other existing sheets are Roseburg, Riddle, Coos Bay, Port Orford, Portland, Ashland, Klamath, Baker, Sumpter, Ironside Mountain and Telocaset, all for sale at ten cents a copy.

The increased appropriation was made in 1911 and since that time three new sheets have been surveyed but not yet published, though they will soon be issued. They are Pine, Arlington and Albany. In addition the Survey completed the Cazadero sheet with its own funds. Besides this finished work, the survey has partially completed the following sheets with co-operative funds: Salem, Reedville, Condon, Corvallis, Lebanon, Monroe, Hillsboro, Brownsville and Elmira, and in addition has done a great deal of control work on the Dallas, Aumsville, Mt. Angel, McCoy, Heppner, and several quadrangles in the John Day Valley. It is expected that the Condon and Reedville sheets will be completed this fall. The survey will also probably finish the Diamond Lake sheet out of its own funds this fall and start the survey of the Kerby sheet.

In the water resource work the Survey has completed maps and stream investigations on a scale of two inches to the mile of the John Day, Deschutes, Metolius, Hood, Sandy, Clackamas, Santiam and Middle Fork of the Willamette. This was done under the co-operative agreement, and the maps and bulletins covering these streams will be published in a few weeks. In fact the Deschutes River report, which will be the most valuable report ever issued for that territory is now on the press. The Survey has just issued Water Supply paper No. 363 covering the "Quality of the Surface Waters of Oregon" which gives the chemical and physical analyses of all the important lakes and streams in the state. This paper is invaluable to all persons who desire to use water for development purposes in Oregon, and may be had free from the Survey at Washington, D. C. Water power development in Oregon cannot be had without full and complete knowledge of the streams in question, such as is gathered by the state engineer and Geological Survey.

In this connection it should be noted that the so-called George bill, purporting to abolish the Desert Land Board, which is soon to be voted on, will also abolish the present office of state engineer and bring all this investigation work to an end. The Portland Chamber of Commerce and many other organizations are fighting the bill on the grounds that it will seriously hamper the development of the state if it passes. There are many places in Oregon that are anxious for topographic maps, but if the George bill passes, the topographic map work will stop, and in addition the sheets that are partially completed will be stopped also and Oregon will have her funds tied up and unavailable. A number of important power streams are not yet mapped, particularly the Umpqua and the Rogue. The George bill should be decisively defeated because of the harm it will work against the state's progress.

Corrosion of cast-iron pipe can be minimized by surrounding it with lime in the trenches in which it is laid. It is also suggested that the trenches not be covered, as the alternate wetting and drying would be preferable to the constant exposure to moist air, salt and carbonic acid in marshy soil.

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A CORRECTION.

In the notice of the plan to hold the national A. I. E. E. meeting at San Francisco in 1915, September instead of April should have been stated as the possible date for a special meeting.

Standards for Gas Service

A valuable service has been performed for the Western gas man by Mr. R. S. McBride in the leading article of this issue. Gas is no exception to the rule that engineering and sales conditions are different in the West. Yet it is interesting to note that the general standards already established for gas service by the U. S. Bureau of Standards are applicable to local conditions. Any points of difference, particularly as regards the manufacture of gas from crude oil, have been carefully analyzed by Mr. McBride and his conclusions are worthy of careful consideration by Pacific Coast gas men.

The West is peculiar in that many companies supply both gas and electricity to their consumers, services ordinarily considered as competitive. Yet by selling electric current for lighting and gas chiefly for cooking and heating, each service is being made to supplement the other. The mild climatic conditions on the Coast favor this division of functions, so that many consumers find it an advantage to have both services.

Serious attention has been given to the utilization of off-peak electric current for the generation of oil-gas, but in the light of present knowledge this does not seem as feasible as the manufacture of electric furnace products.

While Mr. McBride's work was largely in response to the need of public service commissions for more definite information as to proper standards for gas service it has been made possible only by the co-operation of the corporations. Most gas companies voluntarily maintain higher standards of service than have yet been suggested by regulating bodies, realizing that all standards are relative and that the definite standard for each individual is the highest ideal of service of which he can conceive.

The Fruit of Co-operation

Even the most enthusiastic co-operator is occasionally assailed by doubts and doubters of the real "worthwhileness" of co-operation. The good things of this life often seem to gravitate to those who appropriate them without regard to the rights of others. An honest effort to get together for the common weal is misconstrued as a confession of weakness. Competition seems to succeed where co-operation apparently fails. At least we sometimes have our misgivings.

Yet consider a while. All things in nature are arranged in pairs, everything has its counterpart. Heat and cold, light and darkness. positive and negative, optimism and pessimism, good and evil, co-operation and competition. If one did not exist, neither would the other. Competition is the shadow of co-operation.

Co-operation does not mean merely getting together, but acting together. It does not mean cessation of effort, but simply a change in the direction in

which effort has been exerted. Co-operation is action, competition reaction. The conflict between action and reaction is universal and continuous. In the end, however, the eternal law of progress throws the balance in favor of the bright side and compensates for the darkness.

Progress is dependent upon getting together. It is accomplished by union, not dis-union, by harmony, rather than discord, by the bondage of service instead of the license of selfishness. The forward step is always the result of giving, the surrender of self.

The co-operative union of oxygen and hydrogen creates a compound with serviceable properties originally possessed by neither element. Creation is impossible without union. When men unite, new ideas and a crowd-spirit are created for world-service and differing from any individual idea or spirit. Service is the flower of co-operation, progress the fruit.

Nature demonstrates with insistent repetition that new power for service and progress is never created by competition nor selfishness. Progress moves in a spiral of ever-increasing radius and results from sympathetic union, mutual service and hope. So let us continue to co-operate, continue to serve and continue to hope.

The Indeterminate Franchise

Experience has recently demonstrated the wisdom of indeterminate franchises for all public utilities. The success which this plan has given in the operation and control of street railways induced Wisconsin and Indiana to adopt its provisions and other public service commissions would do well to follow this precedent.

The indeterminate franchise or permit of today differs somewhat from the original plan from which it has been evolved. Beginning as a tenure granted during good behavior it was soon found that some provision should be made for caring for the investment in order to induce capital to assume the risks involved. This was accomplished by giving the city, state or federal government the opportunity to buy the property should the franchise be revoked. This not only provides proper governmental control but also protects capital which is invested in good faith in the public service.

Under the Wisconsin provisions the life of every franchise is thus guaranteed until a municipality shall purchase the utility at a valuation to be fixed by the state commission. Furthermore cities cannot construct competing utilities without the consent of the commission. It is now believed that an additional provision should be incorporated in the law which will make obligatory the taking over of the entire property when the franchise is terminated, as otherwise a distributing system or street railway might be claimed and generating plants left without a market.

The same idea is involved in the permits granted to hydroelectric companies by the federal government. Several municipalities, notably Chicago, have found this plan successful in improving traction affairs. Long term or perpetual franchises make regulation difficult, whereas short term franchises restrict the industry so closely that it cannot grow to meet the needs of the community. The indeterminate franchise, however, protects the interests of the public and provides sufficient stimulation for private initiative.

The manifest fairness of this provision for ultimate public ownership without confiscation suggests the propriety of its adoption in these Western states. In California it would merely involve an extension of the commission's power of approval of the terms of sale while in other Western states the present acts must be enlarged. This is a subject which every central station should explain to its legislative representative.

Our Industrial Opportunities

Nations, like individuals are seldom self-sufficient. The interdependence of nations has been demonstrated by the European war. The sudden cutting-off of the supply of many products again forces necessity into the maternalistic role of the inventor, and this country is finding at its very doors materials which it has been wont to bring thousands of miles.

The present period of de-centralization is characterized by a tendency to develop latent natural resources. Particularly is this true in these Western states, which have long been dependent for finished products upon Eastern sources of supply.

It seems the height of economic waste to ship copper matte from Western smelters to the Atlantic seaboard for refining and fabrication into electrical apparatus used on the Pacific Coast. Iron, also might well be refined and cast on the Pacific Coast, especially as vast deposits are available in China. Even today there is a pressing need for Pacific Coast lamp factories, for which ample raw materials and a ready market are available.

It is no idle dream which sees the West one of the great manufacturing centers of the United States within the next twenty years. Already small plants are springing up in communities where cheap power, abundant raw materials and good transit facilities are available.

The supplying of local needs for fertilizers, lamp carbons, glass, wood products and the other products whose manufacture has been but recently undertaken, is only the beginning. South America, particularly, is now looking to this country for commercial co-operation. Bolivia, especially, is anxious to export tin and receive our goods in return.

After proper banking connections have been established, the first essential is to buy these foreign products, which is necessary to establish credit and exchange. This country is rapidly approaching the time when it must import rather than export raw materials. This is a field worthy of careful study by the great electric power companies of this territory, whose future prosperity is dependent upon an industrial population.

PERSONALS

C. P. Platt, a telephone inventor from Chicago, Ill., is a recent visitor at San Francisco.

Wm. M. Strong, hydroelectric engineer of Denver, is a recent business visitor at San Francisco.

J. W. Aberender has been appointed secretary of the Oregon Electrical Contractors' Association at Portland.

J. A. Cranston, manager Portland office of the General Electric Company, spent the past week in San Francisco.

J. H. Siegfried, superintendent of power for the Pacific Power & Light Company of Portland, is visiting Eastern cities.

C. F. Conn, assistant manager San Francisco office J. G. White Engineering Corporation, has recently returned from the East.

L. R. Jorgensen, engineer with F. G. Baum & Co., of San Francisco, has recently returned from a business trip in Arizona.

F. G. Baum, consulting engineer at San Francisco, has recently moved his offices from the Chronicle Building to the Hobart Building.

F. E. Newberry of the F. E. Newberry Company is spending a couple of weeks in San Francisco, having recently arrived on the Coast from the East.

H. L. Bleecker, superintendent of the Washington Water Power Company, Spokane, Wash., who was in Seattle on business, has returned to Spokane.

H. V. Carter, president Pacific States Electric Company, San Francisco, returned the first of the week from a business trip to Portland and the Norhtwest.

W. H. Whiteside, president Stevens-Duryea Company, formerly president Allis-Chalmers Manufacturing Company, is a recent business visitor at San Francisco.

A. J. Myers, Pacific Coast manager Wagner Electric Manufacturing Company, will return from an extended business trip throughout the Southwest next week.

E. C. Fellows, motor specialist, at the Seattle office of the General Electric Company, has returned from an extensive hunting trip in Western Washington.

R. J. Davis, Western manager Century Electric Company of St. Louis, has returned to San Francisco from his trip East, where he visited the company's factories at St. Louis.

G. H. Wheeler, manufacturers' agent San Francisco, has succeeded W. S. Heger as representative of the Edge Moor Iron Company, manufacturers of the Edge Moor boilers.

G. McClellan, formerly agent for the Pacific Power & Light Company at White Bluffs, has succeeded **C. E. McNeil,** resigned, as local manager at White Salmon, Washington.

H. A. Lardner, vice-president of J. G. White Engineering Corporation, has returned to San Francisco from a short trip to Los Angeles. He is expecting to leave for the East soon.

A. S. Grenier, vice-president of the American Power & Light Company, recently made an inspection of the Pacific Power & Light Company's properties in Oregon and Washington.

J. A. Delaney, Seattle, Wash., has invented an electric governor and automatic stop for machinery, steam, gas or electrical, which the inventor claims can be attached to automobiles.

W. S. Heger, Western director Busch-Sulzer Bros. Diesel Engine Company of St. Louis, is making a business trip throughout the Northwest, and **W. S. Heger Jr.** is traveling throughout Arizona.

J. E. Wickstrom, hydraulic engineer, Seattle, has just completed the reconstruction of the electric light plant, the building of a substation and the installation of head gates for the lighting system at Gold Bar, Washington. He is at present engaged in extending a high power transmission line across the Columbia River below Wenatchee, Washington, for a water consumers' association.

Paul H. Affolter, manager electrical department, Fairbanks, Morse & Co., of San Francisco, underwent an operation on his neck at a hospital in Berkeley and is doing nicely. He expects to be back in his office in about a week.

J. Harry Pieper, engineer illumination and vehicles for the Southern California Edison Company, has been elected chairman of the Jovian Electrical League at Los Angeles. **H. F. Anderson,** division superintendent of plant for the Pacific Tel. and Tel. Company, is vice-president, and **J. O. Case** of the General Electric Company, secretary and treasurer. The other directors are **H. W. Allen** of the Holabird-Reynolds Electric Company, and **J. E. Wilson,** electrical dealer.

J. C. Martin of the Pacific Power & Light Company, **L. T. Merwin** of the Northwestern Electric Company, **H. R. Wakeman** of the Portland Railway, Light & Power Company, **G. E. Quinan** of the Puget Sound Traction, Light & Power Company, **E. G. Robinson,** Jim Creek Water, Light & Power Company, and **J. B. Fisken,** Washington Water Power Company, have been appointed members of the committee on Overhead Line Construction of the Northwest Electric Light & Power Association, by President O. B. Coldwell.

Clark Baker, field representative Mazda Bureau of the General Electric Company, and **F. J. Blaschke,** who is in charge of the publicity and exhibits of the same department, returned from Santa Rosa, where they established a Mazda week. All the electric stores decorated their show windows for the occasion, which added greatly to the success. Mr. Blaschke leaves on a business trip for the East October 24th, to be gone about three weeks. Mr. Baker is at Bakersfield, where he intends to establish a Mazda week from October 26th to November 2nd.

S. Z. Mitchell, president of the Electric Bond & Share Company of New York, one of the leading authorities of the country on electrical securities, was at Boise, Idaho, recently renewing acquaintances made in Boise in the early days. Mr. Mitchell built the first light plant in Boise in 1887. He also constructed the plants in Pocatello, Hailey, Caldwell, Union, Oregon, La Grande, Baker City, Portland, Tacoma, Wash., Seattle, Spokane, The Dalles, Vancouver, B. C., Victoria, B. C., and many others in the Northwest. He is now engaged in financing electric properties, especially in the Northwest. He will probably make a trip of inspection over the lines of the Pacific Power & Light Company when he reaches Portland later in October.

MEETING NOTICES.

Jovian Electrical League of Southern California.

The weekly luncheon of the League, held at Christopher's on Wednesday, October 14th, was attended by over 100 Jovians and a number of visitors. The meeting was in charge of O. L. Howard, who had secured, through the Pacific Electric Railway Company, a splendid universal program. The secretary read his annual report and a nominating committee was appointed by Statesman Colkitt, consisting of J. G. Pomeroy, R. G. Perle, N. W. Graham, E. R. Northmore and A. G. Drake. An interesting lecture was delivered by Rev. Frederick W. Carstens entitled "Does Europe's Day of Extremity Create America's Day of Opportunity?" The speaker, while greatly deploring the terrible ravages and consequences of war, could not fail to see the beneficent moral effects resulting from the struggle in the raising of the standards of the world's ideals. He urged upon his hearers the necessity and opportunity of supplying to the warring nations not only merchandise and produce, but ideas and ideals as well. He desired them all to take a vital interest in the moral as well as commercial opportunities.

INTERNATIONAL ENGINEERING CONGRESS.

San Francisco, September 20-25, 1915.

Since the development of the war situation in Europe the committee of management for the International Engineering Congress has given serious thought to the question of the modifications which may become necessary in the plans for papers and publications of the transactions.

The total number of papers contemplated was about 290. Of this number about 220 are either definitely promised or well assured, among which are included contributions from England, Spain, Sweden, Holland, Canada, India, Italy, China, Japan, Australia, and various South American countries. The remainder, apportioned chiefly among the nations in the present European war zone, are uncertain, and it must be expected that some portion of them will not be secured.

It is believed, however, that by substituting for these papers certain others which have been offered, and by taking advantage of other conditions which may yet arise, the general plans of the Congress may be carried out with a minimum of change.

Timely notice will be given regarding any such changes in detail, should they become necessary.

In the circumstances which have developed as a result of the European war,the committee is more than ever in need of strong and immediate support from American engineers, who are urged to subscribe promptly, and help to prove that American engineers can carry to successful issue an International Engineering Congress in spite of the war situation abroad.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The San Diego Gas & Electric Company, operating over about 600 miles of territory in San Diego county, has filed an application with the commission to issue $500,000 face value of 6 per cent debenture bonds to be used in discharging indebtedness.

The Escondido Utilities Company, operating a gas and electric system in San Diego county, has filed an application with the commission to determine the validity of a $16,000 promissory note in favor of W. S. Sheperdson, and $32,000 of bonds pledged as security for the note—the note having been executed and the bonds pledged without securing the consent of the commission.

The commission has issued a supplemental order authorizing the San Joaquin Light & Power Corporation to issue a one year promissory note in the sum of $10,000 to the Bank of Central California. The note is to bear interest at the rate of 7 per cent per annum.

The commission has issued an order authorizing the Fresno Interurban Railway Company to issue $12,000 of stock and $24,000 of bonds—being a part of 600 shares of common stock and $120,000 first mortgage bonds previously passed upon by the commission.

The commission has rendered a decision authorizing the Pacific Power Company, which operates a hydroelectric plant on Mill Creek, Mono county, to issue promissory notes of the face value of $76,000 in lieu of other notes previously issued without the consent of the commission.

The commission has rendered a decision authorizing the Western States Gas & Electric Company to issue $731,000 3 year 6 per cent promissory notes at a price not less than 92½ per cent of their face value, plus accrued interest. The proceeds from the sale of these notes will be used by the company to discharge floating indebtedness and open accounts in the sum of $135,000.

The commission has rendered a decision authorizing the San Diego Electric Railway Company to execute a trust deed to the Union Trust Company of San Francisco, securing a possible maximum issue of $10,000,000 general first lien sinking fund gold bonds, bearing interest at the rate of 5 per cent per annum. The company is given authority to issue $4,497,000 face value of these bonds at the present time, to be used in refunding outstanding bonds and other indebtedness; to return the sum of $302,438.26 to income, and to defray the expense of making necessary additions and betterments to the property. The commission's order provides that the bonds shall be sold so as to net not less than 85 per cent of their face value together with accrued interest.

The commission has rendered a decision authorizing the Humboldt Transit Company, which operates a street railway in the city of Eureka, Humboldt county, to issue and pledge $50,000 of its first mortgage 5 per cent bonds with the Pacific Coast Casualty Company as collateral security for a surety bond.

The commission has rendered a decision denying the application of the Southern Pacific Company to raise the transbay commutation rates between San Francisco and Oakland, Berkeley, Alameda and other Alameda county points. At the same time, the commission stated that the Southern Pacific Company should not be compelled to further extend the present 10 cent single fare and $3 commutation zone.

The Marin County Electric Railways has filed an application with the commission requesting a certificate of public convenience and necessity, authorizing it to construct a street railroad in the town of Sausalito, Marin county, under a franchise granted by the board of trustees of that town. The company also asks permission to issue and sell 150 shares of capital stock, having a par value of $150,000, with permission to start work on private funds pending the sale of the stock.

The Pacific Gas & Electric Company has filed an application with the commission, requesting authority to renew a promissory note in favor of the National Conduit & Cable Company, in the sum of $100,000, for a period of 90 days, at 6 per cent per annum.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The public utilities commission is hearing the complaint of the Marsh Mining Company against the Washington Water Power Company. The case involves a charge of discrimination made by the mining company. The complaint and answer were filed with the commission some time ago, but the attorneys have been unable to get together at any time since until recently, though the case has been set for hearing several times. The Marsh Mining Company has a contract with the power company which recently expired. At that time the mining company refused to renew at the old rate, claiming that it was higher than that charged other companies in the same section. It tendered to the power company the amount it believed to be fair and reasonable, and this proved to be three thousand or four thousand dollars less than the power company asked. The power company then threatened to shut off the power unless the mining company paid the balance and agreed to the rates. The utilities commission, on application from the mining company, asked the power company to continue the service until the case could be heard.

The matter was taken under advisement by the commission, but an early decision is expected because of the urgency of the matter. Rates in the north are not involved and will not be passed upon at that time.

There is a complaint from the Hecla and Federal Mining Companies before the commission at the present time which will determine, on its decision the reasonableness of all power rates in the north, but this has been postponed until the Supreme Court could pass on some phases of the matter. A hearing was had at the last session of the court at Lewiston, and a decision is expected soon which will allow the case before the utilities commission to proceed. A. G. Kerns, attorney, and W. E. Greenough, general manager, both of Wallace, appeared for the mining company, while the power company was represented by its president, D. L. Huntington, and its attorney, F. L. Post, both of Spokane.

DISCUSSION ON RATE THEORIES.

[Continued from page 387.]

Mr. Cotton seemed to think that you could charge for service rendered to the public much the same as one would for drawing a gallon of cider out of a barrel.

The days of flat-rates are going rapidly.

As has been said in your former discussions, a charge has been made for carrying a letter—2c—whether it be carried 2 miles or two thousand miles. Every rate charge made must be a compromise between justice and efficiency. In carrying a letter 90 per cent of the cost is in terminal charges. It doesn't depend upon the distance through which it is carried. The block system of telephone rate in the state of Washington was fixed by the division of the state into ten-mile blocks. The cost of the message should be a certain sum for the first block and a certain additional sum for the next block. When the matter was up before the commission I endeavored to find out if any computation had been made by engineers throughout the country, or by the company, to determine the terminal cost. If the terminal cost of sending a message is 60 per cent of the total cost to send that message, then the rate should be based upon the terminal cost, plus the line-cost.

In the matter of gas rates I came to the conclusion that the absolutely equitable gas rate, insofar as such a thing is possible—would be fixed in this way: a certain fixed charge to cover overhead and consumers' expenses, based upon fair service, then another charge to be made for the service, depending upon the amount of service rendered. We had a report from an expert in the gas business, and the report showed that a proper charge to cover overhead expenses would be 15 cents a meter-light. With gas at the rate of 50 cents per thousand feet, the ordinary residential consumer, having a 5-light meter, would pay 75c a month. After that his rate would be dependent upon the cost and distribution of the product. If he consumed only 200 or 300 ft. of gas, he would pay 75 cents, plus 50 cents, or $1.25 per month for the first 1000 ft. of gas—simply prohibitory for the small consumer.

That is where the proposition of expediency as against justice comes in. I believe practically every consumer who uses less than the minimum instead of more than the minimum is exceptional.

In a compromise we must make the large consumer pay part of what we render to the small consumer. I believe that principle will always be recognized in the fixing of rates.

A merchant in this city asked me the other day if I had anything to do with the reduction of rates by the Washington Water Power Company. I said yes, swelling out my chest. He replied, "I thought so." Last month my house bill was 30 cents less than the previous month, and my store bill was $25 more. My hope and wish in the business of fixing rates for electric light companies is that the rates should be as low as possible. I am just a citizen and taxpayer. The rates should be as low as they can reasonably be made and render an equitable return on the company's investment.

The rates should also be as simple as possible—that is the rate-making on the bills. When you commence to figure in all the data on those bills an electrical engineer could not make out your bill for you. Something in accuracy should be sacrificed to simplicity. If we yield something to compromise, wouldn't it be wise to yield just a little bit more? Have the bills so simple that men may know how to figure their own bills and find the same total as you do when computing it.

I believe that the public service commission in the various states should always have in mind the cost of the plant, the actual money invested, the risks involved, the lean years, and that the return should be full and equitable to the men who have furnished the money and brains to build up these plants. I believe public service commissions have a right and a duty to raise rates when they find they are confiscatory. I do not believe the railroads are all going to "hell" as Mr. Cotton showed. He showed how rates had dropped since the regulation of rates had been enforced. Mr. Cotton didn't inform you though that the common stock had been given as a bonus to the holders of it; that it was largely watered-stock. I want to say to you that the amount of dividends paid upon common stock has absolutely and greatly advanced along all these years. Ten years later, under the conditions that existed, there were paid dividends of 7.4 per cent upon railroad stocks outstanding. That doesn't look like confiscation.

H. L. Gray (former chief engineer of the Washington Public Service Commission): I was somewhat impressed by Mr. Fassett's remarks which had a particular bearing on rates. In connection with the rate of residential lighting it was brought out that the power used in supplying residence business is due to certain elements, whereas the power is consumed on an entirely different basis. Practically all the revenue in the residential lighting in small towns is obtained from power on the kw-hr. basis. It is at least not based on consumption by the individual consumer. It is all due to other things—demand, number of consumers, density of population, and distance from the generating plant.

Mr. Osborn spoke of consumption by high efficiency lamps. It seems to me that the rate is to be a combination of meter and flat rate. There is nothing wrong with the kw.-hour meter rate. It gives the factor you are looking for and is something tangible the consumer can grasp. But it seems to me that there must be taken into consideration the service rendered.

In a commission appointed by the National Rate Association they stated that a rate should be determined by the value of the service rendered. It looks like the regular rate is to be a combination of flat and meter rate. Sell power on candle rates.

One question I have heard raised frequently of late is: Why is the kw-hr. rate higher in some small towns than in a large city? I have heard it raised a great many times by commissions. My answer is brief: "The rate per kw-hr. charged in a small town remote from the generating station must be greater than that charged in a large city, for the following reasons:

1. In large cities, both the system load factors and the class load factors are higher than in the case of small towns. In other words a greater number of kw-hr. per kilowatt of system demand are sold in the larger cities. This is due to the higher load factor of each class of service, and to the diversified use of power in large cities, which tends to increase the consumption without increasing the maximum demand, the demand being the controlling element of the cost of production and distribution.

2. All other things being equal, a city remote from a generating plant must pay a higher rate per kilowatt hour for power consumed, than a city nearer the generating plant, due to the greater investment to serve the former. This should require no further comment.

3. Owing to the lower load factor and lack of diversity in a small town, together with the smaller consumption, the general and managerial expenses of such a town are almost always greater per unit of consumption than in the case of a large city.

4. Again, owing to the low consumption in the small town, the cost of maintenance is frequently greater per unit of consumption than in a large city, owing to the more permanent construction in the latter.

5. In large cities, the consumption per dollar invested in the distribution system is generally greater than in small towns. This will, of course, increase the fixed charges on the distribution system, which will increase the necessary kw.-hr. charges.

SUGGGESTIONS FOR ESTIMATING SHEET, Alameda County Electrical Development League.

Owner ..... Date .....
Contractor ..... Location .....
Architect ..... Address .....

	Outlet.	S. P. Sw.	3 Way.	Base P.	Iron P.	Lts.	Cir.	Bells.	Tel.
Basement									
First floor									
Second floor									
Attic									
Total									

Quantity.	Article.	Cost.	Quantity.	Article.	Cost.
	Inspection			Single Plates	
	Conduit			2 Gang Plates	
	Condulets			3 Gang Plates	
	Condulets			4 Gang Plates	
	Service Box			S. P. Flush Sw	
	Ground Clamps			3 Way Flush Sw	
	Ground Wire			S. P. Snap Sw	
	Feed Wire			3 Way Snap Sw	
	Service Switch			Base Plugs (Con.)	
	Cutouts			Iron Plugs (Con.)	
	Cutouts			Bells	
	Cutouts			Buzzers	
	Asbestos			Batteries	
	Cabinet Bob			Bell Transformer	
	Fuses			Push Buttons	
	Fuses			Floor Push	
	Sub. Feed Wire			Table Clamp	
	Sub. Feed Wire			Bell Cord	
	No. 14 R. C.			Bell Wire	
	No. 12 R. C.			Tel. Wire	
	No. 10 R. C.			Speaking Tube	
	No. 8 R. C.			Speaking Tube Whistle	
	2/8 in. Loom			Speaking Tube Mouth Piece	
	1/4 in. Loom			Speaking Tube, Elbows	
	3/8 in. Loom			Tape, Solder, Paint	
	3 in. Bushings			Pipe Straps, etc	
	4 in. Bushings				
	5 in. Bushings				
	6 in. Bushings				
	No. 5½ Solid Knobs				
	No. 5½ Split Knobs				
	Outlet Boxes				
	Outlet Plates				
	Gas Clamps				
	Loom Clamps				
	Single Sw. Boxes				
	2 Gang Sw. Boxes			Cartage	
	3 Gang Sw. Boxes			Labor	
	4 gang Sw. Boxes			Car Fare	
	Spacers				

Total Cost.....
Gross Profit .....
Bid Price .....

NEW CATALOGUES.

The General Electric Company has just issued an interesting bulletin, No. 48014, on Mine Hoist Equipments. The bulletin is profusely illustrated, takes up the question of economy of electric drive, and treats of the general subject of underground hoists, their operation and control. Bulletin No. 46390 describes Direct Current Test Meter, known as Type CB-5 showing the construction of the meter in detail, and containing diagrams of connections. Bulletin No. 42800 contains a reprint of an article appearing in the General Electric Review, and devoted to the use of electrically driven air compressors in foundries.

Bulletins Nos. 4500, 4510, 4520 and 4530 describe the new Cutler-Hammer line of automatic machine tool controllers for use with shunt or compound-wound d.c. motors, adapted for constant or adjustable speed work, with or without interpoles. Bulletin 4510 describes automatic machine tool controllers of the plain starting type; Bulletin No. 4520, those of the speed setting type, and Bulletin No. 4530, those of the speed regulating type. Bulletin No. 6753 describes double-pole diaphragm regulators for d.c. and a.c motors; Bulletin No. 7131, full magnetic controllers; Bulletin 9125, secondary resistance starting rheostats for polyphase slip ring motors; Bulletin 9130, multiple-switch starters; Bulletin No. 9135, drum type starters; Bulletin 9155, drum reverse switches; Bulletin No. 9320, panel type speed regulators; Bulletin No. 9350, drum reversible crane controller; Bulletin No. 9355, hoist controllers; Bulletin No. 9359, rope operated drum reverse switch; Bulletins Nos. 9360 and 9365, speed regulators.

PUBLICATIONS RECEIVED.

Of the several central station "house organs" which are received at this office, "Current News," from the Philadelphia Electric Company, N. E. L. A. Section, furnishes an example of what such a publication can do. The September issue is a commercial number. Beautiful cuts, paper and printing, well-edited departments and material of personal interest to each company employee are found in the 88 pages which make up this monthly publication. Wisely recognizing the folly of compelling advertising from the firms on the purchasing agent's list, the management makes no effort to masquerade under any false pretense. The Union Electric Bulletin, from St. Louis; Current Topics, from the Southern California Edison Company of Los Angeles; the Pacific Power and Light Company Bulletin, and the Edison Magazine, from the New York Edison Company, also follow this practice.

INDUSTRIAL

NEW OIL TESTING SET.

With high voltage oil insulated apparatus, in order to insure successful operation, it is necessary to maintain the dielectric strength of the oil at maximum value. A testing set has recently been developed and placed on the market by the General Electric Company for determining the dielectric strength of oil.

This set consists of a testing transformer with an induction regulator for voltage control and an oil spark gap. All of the various parts are assembled and mounted so as to form one complete unit, which is compact and neat in appearance and, at the same time, may be conveniently and quickly operated. The set is built for both 25 and 60 cycles.

The transformer has a rating of 3 k.v.a. at 30,000 volts, but may be operated at 10 per cent above this figure. The high voltage winding is equipped with a voltmeter coil for indicating directly the test voltage. The transformer tank is of drawn seamless steel and the cover is fitted so as to be oil tight, permitting shipment filled with oil. The induction regulator is specially designed for the testing set and allows a variation of the test voltage from zero to maximum. The regulator, as well as the transformer, is arranged for series-parallel connection, making the set suitable for use on 100 or 200 volt circuits. A dial is attached to the top of the rotor shaft of the regulator and is accurately graduated to give readings of the test voltage directly in kilovolts.

Type M 30,000 Volt Oil Testing Set.

The set may also be equipped with a small portable voltmeter for reading the test voltage, provision being made on all outfits for mounting an instrument specially designed for the set. This instrument is of the dynamometer type, is very accurate and the scale is graduated to read the test voltage in kilovolts.

The oil is tested between flat metal discs, which are located inside the receptacle. One electrode in stationary, and the other has a micrometer adjustment with an adjustable zero index. This permits taking up readily any wear in the gap. The receptacle is designed so that it may be very conveniently cleaned. Care has been taken that the quantity of oil required for tests is as small as is consistent with good results. It is estimated that three-quarters of a quart of oil is sufficient for one sample, allowing five tests on clean oil.

The oil receptacle and spark gap are supported by the high voltage terminals of the transformer. By merely turning the receptacle about its horizontal axis, the oil which has been tested may be emptied, being caught by a depression in the transformer cover and flowing away through a pipe.

Oil Spark Gap Mounted as a Separate Unit.

The receptacle and gap may also be easily removed from the supports, leaving the transformer free for high potential testing of any kind up to 33,000 volts.

This apparatus is also equipped with a small sensitive circuit breaker of novel design, which is attached to the side of the regulator and is likewise specially designed for the apparatus, the set may also be mounted on a truck, making it portable.

The outfit is complete in every essential detail, being all assembled in one unit, which makes it compact and convenient to operate and easy to obtain quick and accurate results. The use of the induction regulator for voltage control produces no noticeable distortion of the e.m.f. wave shape and therefore contributes considerably to the accuracy of the test results.

The weight of the 60 cycle set complete is 465 lbs., height 30 in., length 24 in., width 17½ in.; the weight of the 25 cycle set complete is 670 lbs., height 32 in., length 26½ in., width 20½ in.

TORQUE COMPENSATORS.

The Westinghouse Electric & Manufacturing Company has introduced a new device known as a torque compensator, intended primarily for modifying the time element characteristics of an alternating current overload relay. It reduces the torque of the relay at heavy overloads without reducing the torque at light loads. It thus increases the time element of the relay at overloads, its effect being in proportion to the overload.

The overload relay with definite minimum time element obtained by a torque compensator provides selective action of circuit breakers where feeders are placed in series. The relays controlling breakers nearest the source of power can be set for slightly greater time element than those further along. The difference in time is retained at all overloads with sufficient accuracy to cause the breakers nearest the trouble to open thus confining the inoperative section to the smallest area, without interruption of service on part of the system between the trouble section and the source of power.

Another use of the relay with definite minimum time element is in relieving circuit breakers. It is well known that the ultimate breaking capacity of a circuit breaker depends on the time of breaking. If a ground or short circuit can persist for two seconds before the circuit is opened, the ultimate breaking capacity is greatly increased; that is, the strain on the breaker is reduced very materially,

owing to the drop in voltage and current occurring during the interval.

The torque compensator consists essentially of a small auto-transformer connection between the relay and the current transformer on the line. It is so designed that at a certain value of current, the core of the compensator becomes saturated, and any further rise in current results in an increasing impedance drop so that the current in the relay circuit does not increase in proportion to the current in the line.

The ordinary time adjustment provided on standard relays will give the desired definite minimum time element within the range characteristics to each relay. In the Westinghouse relay this range is from 0 to 2 seconds.

The winding and core are enclosed in a neat box with sides perforated for ventilation. The compensator can be mounted on any convenient place, such as the rear of a switchboard behind the relay it controls.

NEW ENCLOSED REVERSING SWITCHES FOR HIGH TORQUE SQUIRREL CAGE MOTORS.

The enclosed drum type reverse switches recently developed by the Cutler-Hammer Manufacturing Company of Milwaukee are designed for the reversing of small polyphase induction motors that may be thrown across the line in starting. As shown in the accompanying illustrations provision is made for operating by means of a rotary handle or by means of ropes. In the latter case the drum switch may be installed out of reach, and in a position the reverse of that shown. These switches are also adapted for use on small a.c. elevator equipments driven by high resistance rotor squirrel cage motors. The enclosing case protects the switch contacts from dust and dirt, and prevents accidental contact of the live parts by the operator or workman.

Hand Type and Rope-Operated Type of Reversing Switch for Squirrel Cage Motors.

THE MIRRORLITE.

The Mirrorite is a new and unique development in portable lamp, consisting of a portable mirror, a metal reflector, a lamp socket, a silk cord and an attachment plug. The socket is mounted directly on the base by means of a hinge joint which permits the adjustment of the lamp and reflector through a wide range of angles. The mirror, six inches in diameter, is supported by three clips, flush with the opening of the reflector. The mirror is surrounded by an open space of one inch through which the light is diffused. The Mirrorlite was originally designed for the man who shaves himself. With one adjustment it illuminates all parts of the face—under the chin and both cheeks. However, after the clips have been released and the mirror removed, advantage can be taken of its adjustable features by using it on the sewing machine, the piano and the writing desk. A plug on the base provides for hanging it on the wall. The unit is manufactured by the Holophane Works of General Electric Company.

WESTINGHOUSE LITERATURE FOR A. E. R. A. CONVENTION.

The Westinghouse Electric & Manufacturing Company has issued quite an elaborate lot of literature in connection with the A. E. R. A. Convention to be held at Atlantic City, October 12th to 16th, consisting of the following publications:

Railway Date Exchange No. 10 contains a considerable amount of data pertaining to the operation of street railways, dealing more particularly with the following subjects: improvement of voltage on interurban lines, effect of voltage on performance of motors, cost of stops and trailer operation, saving energy, train operation in city and interurban service, as well as a number of other equally important subjects in the treatment of which considerable valuable data is given.

Heavy Traffic Centers, Circular 1549, shows a large number of handsome engravings illustrating the heavy traffic centers in various large cities throughout the country where surface lines are equipped with Westinghouse apparatus.

1500-volt Direct Current Substation Equipments, No. 1550, as its title indicates, deals with this class of apparatus. Descriptions of a number of different roads throughout the country which are using this type of equipment are given, a number of which are profusely illustrated. Maps are also given of these properties showing the territory covered, and considerable operating data is also included. Switchboards and accessories for use on 1500-volt direct current lines are also illustrated and described.

Train Operation for City, Suburban and Interurban Service, No. 1546, is a collection of illustrations with brief notes showing the advantage to be derived from the use of multiple unit trains. This book is also well illustrated with views of a number of properties in all parts of the country which make use of the multiple unit train equipped with Westinghouse apparatus.

Among the interesting features are some curves showing the small amount of current required for a high-speed interurban car when handled in a careful manner.

Following its usual custom, the Westinghouse Company has this year issued a Progress Leaflet (No. 1553), in which is outlined the progress made by the company in electric railway apparatus. Among the items included this year are the Philadelphia Terminal electrification of the Pennsylvania Railroad; the electrification of the Norfolk & Western Railway Company of the Bluefield Division in Virginia; the recent addition to the New York, New Haven & Hartford road and a large number of other steam railroad electrifications, and city surface, elevated and subway lines both at home and abroad.

The Westinghouse Exhibit at the A. E. R. A. Convention is attractively described in Circular 1551, with an art cover, representing the well-known "Joe and the General Manager" leaving for Atlantic City. This scheme is followed throughout the book in which Joe and the General Manager discuss the various pieces of apparatus in the Westinghouse Exhibit.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—A dispatch from Albany announces the incorporation of the Mt. Whitney Power & Electric Corporation of New York with a capital stock of $4,800,000. The directors are Harris Hammond, R. D. Hanna, T. T. Trapnell, all of New York, and Charles R. Blyth of this city. The announced purpose of the new corporation is to take over the stock of the Mount Whitney Power & Electric Company of California. No reason is given for this change. Some time ago it was announced that the Mount Whitney Company would issue $500,000 preferred stock, the proceeds to be used in taking up floating debt. There being no general market for the stock at a price which would be allowed by the commission, it was purchased by John Hays Hammond, the principal holder of the common stock. It is probable that the reincorporation in New York means that the new company will issue the preferred stock after acquiring all the common stock of the operating company.

FINANCIAL.

SAN FRANCISCO, CAL.—Chairmen and secretaries of the protective committees of the different classes of holders of the Northern Electric securities have been chosen by the committees as follows: Unsecured creditors committee—A. M. Irwin, chairman; A. L. Reed of Suisun, vice-chairman; Benj. Upham, secretary; Northern Electric committee—Vanderlynn Stow, chairman; Phillip I. Manson, vice-chairman and secretary; Northern Electric Railway committee—Judge M. H. Hyland, chairman; Carl Raiss, secretary.

NORTH YAKIMA, WASH.—Judgment for $346,025 in favor of the Dexter-Horton Bank and for $497,945 in favor of the American Power & Light Company, has been given against the Hanford Irrigation & Power Company in a decree filed in the United States Court. The claim of the banks as trustee for the bondholders is given priority. Sale of the Hanford Company's lands, pumping site, irrigation canals and other property is ordered to be made by the receiver after published notice, $380,000 being named as the upset price. The property will pass free of all claims, except that it is subject to the existing rights of water users holding contracts from the Hanford company.

LOS ANGELES, CAL.—The Midway Gas Company has announced a plan of reorganization that will, its sponsors believe, lift the property out of difficulties. The company has outstanding $1,500,000 6 per cent serial bonds due as follows: $60,000, December 1, 1913; $90,000, 1914; $120,000, 1915; $150,000, 1916; $180,000, 1917 to 1922 inclusive. The first maturities have been retired, having been purchased by stockholders, but there is no prospect that the next maturities could be redeemed. The reorganization plan provides for the issuance of a similar amount of 15 year 6 per cent bonds secured by first mortgage on the entire property. It is provided that all earnings after operating expenses, taxes, interest and preferred dividend shall be paid into a fund for the redemption of the outstanding bonds in the same order that they would be retired under the present organization. The new bonds changed for the shortest maturity of old bonds will be redeemed first from the fund to be accumulated for that purpose, the difference between the two plans being that the company gives no guarantee of redemption at any fixed period of 15 years. The reorganization committee which has been asked to act is composed of C. Pierce, Ferdinand Reis Jr., S. Waldo Coleman, W. G. Kerckhoff and H. R. Tobey. Jared How has been retained as counsel to the committee.

SAN FRANCISCO, CAL.—B. H. Dibblee, vice-president and Pacific Coast manager of E. H. Rollins & Sons, says that the proposed Northern Electric Railway Company reorganization is unfair to the first mortgage bondholders. "This plan, in that it contemplates taking care of the junior creditors and the present stockholders, ignores the prior right of the first mortgage bondholders to be paid back their money or take the property covered by their bonds before the junior creditors receive any consideration. My firm has absolutely no interest in this property and has never sold a dollar's worth of its securities to its customers, but I believe the time has almost arrived when some concerted action should be taken by bond houses in San Francisco to prevent reorganizations being put through in the interests of junior creditors and at the expense of bondholders. The Northern Electric first montgage bondholders in this case can demand their rights, and, if their bonds are a legal first mortgage on the principal part of the property of the company, enforce their prior lien, if they so desire; and I sincerely hope they will do so. If they do, I believe they can ultimately get their money back. Unless there is a legal complication, I can see no legal reason for the first mortgage bondholders to surrender the equity in the property to the junior creditors and present stockholders, for no consideration whatever, than there would be for any one, in foreclosing a mortgage on a piece of real estate, to surrender the title representing the equity to the original owner. The proper way for the junior creditors to protect their interests would be to purchase the property themselves at foreclosure sale for a sufficient sum to satisfy the first mortgage bondholders; or to offer a valuable consideration to the first mortgage bondholders for the privilege of retaining an interest in the reorganized company. From my knowledge of the policy of the railroad commission of the state of California, which would ultimately have to authorize the issuance of all new securities in case of a reorganization of this property, I do not believe they would authorize any securities under the reorganization plan as suggested."

ILLUMINATION.

SEQUIM, WASH.—The council has granted an electric light and power franchise to J. L. Keeler.

GILROY, CAL.—The matter of selling the city electric light plant and franchise is under consideration by the council.

CATHALMET, WASH.—A bond issue of $4200 has been voted for the purpose of installing a muncipal electric lighting plant.

WINNEMUCCA, NEV.—W. J. Compton and Frank L. Reber have applied for a 25 year franchise to operate a gas plant here.

TACOMA, WASH.—The council has authorized Superintendent Collins of the city light department to purchase $20,000 worth of incandescent lamps.

PORTLAND, ORE.—The East Side Business Men's Club met recently to receive reports for the committee on the cost of lighting Grand avenue by gas and electricity.

SAN DIEGO, CAL.—A protest against the proposed ornamental lighting system on Fifth avenue from A to Laurel has been filed with the council. The cost is said to be excessive.

STOCKTON, CAL.—The Western States Gas & Electric Company plans to install a new street lighting system in Stockton, and to undertake general construction work in the cities of Richmond and Eureka.

MONROVIA, CAL.—The Keystone Iron Works has been awarded the contract for furnishing 60 cast-iron electroliers to be used on Myrtle avenue, between White Oak and Falling Leaf avenues, on its bid of $6658.

FLORENCE, ARIZ.—R. G. Arthur, general manager of the Florence Improvement Company has announced that his company will not be able to take up the matter of an electric light plant for Florence before December 1st.

WHITTIER, CAL.—President Ferdinand Bain of the Southern Counties Gas Company, which now furnishes artificial gas for Whittier, has made the assertion that the city is to have natural gas supplied by the same company.

MARTINEZ, CAL.—Work will begin immediately on the feeder and pipe lines of the new Contra Costa Gas Company, according to President S. W. Coleman and service will be furnished by the middle of February. The Hooper estate at Pittsburg has been purchased for the main plant site, and it is proposed to furnish Martinez, Concord, Antioch and Pittsburg with gas.

PASADENA, CAL.—Resolutions of intention for the establishment of three ornamental lighting districts will be acted upon by the city commissioners within a short time. The projects that will soon be under way are on El Molino avenue from Colorado street to Woodland road, South Fair Oaks avenue from Dayton to California street, and Bellefontaine street from Fair Oaks avenue to Orange Grove avenue.

LODI, CAL.—The city purchased from the Western States Gas & Electric Company the equipment which is now supplying the Hutchins and Schroeder additions to this city with electricity. These two additions were annexed to the city last April. The Western States will continue to furnish the residents with electric light until the 25th of this month, at which time the city will take over the lines. The purchase price was $1370.

PORTLAND, ORE.—Additional lighting systems are authorized by the city council as follows: The principal special appropriations allowed were for installing lighting systems in parks. By putting lights in the parks Mayor Albee says he will not have to need as many additional policemen as had been asked for. Special appropriations for lighting apparatus were granted in parks as follows: Holladay Park, $1140; Kenilworth Park, $1500; Laurelhurst Park, $8000.

TRANSMISSION.

MERCED, CAL.—A hydroelectric power plant will soon be constructed at the Mountain King mine in Mariposa county, which will furnish 400 horsepower as compared with 75 horsepower now furnished by the water plant.

SAN FRANCISCO, CAL.—Plans have been completed by the city department of architecture, and turned over to the board of public works, for the central power station which is to be erected in the Civic Center to supply light and power to the various buildings. The building will be erected at the corner of McAllister and Larkin streets and will be of the reinforced concrete type. About $75,000 is available for construction.

TRANSPORTATION.

FRESNO, CAL.—The Fresno Traction Company has been granted a franchise to construct a double track street railway upon certain streets in this city.

BENICIA, CAL.—A. D. Bowen has been granted the right to construct and operate an electric railroad, single or double track, upon certain streets in this city.

OGDEN, UTAH.—At a meeting of the board of directors of the Ogden Rapid Transit Company this afternoon the general contract for the new interurban passenger station on Twenty-fourth street was awarded to C. F. Dinsmore of Ogden. While the contracts for the electric wiring and heating have not yet been awarded, General Manager P. D. Kline of the traction company declared today that the total estimated cost of the new station would be $25,000. The terminal will be erected for the joint use of the local company and the Salt Lake & Ogden Railway Company.

FAIRFIELD, CAL.—To obtain a right of way through Jamison canyon in this county, the California Terminal Railway Company has filed condemnation complaints against Josiah Z. Morrison, M. T. Freitas, Daniel Madigan, James Moore, William Higgins, Melville Dozier and the Vallejo & Northern Railroad Company. The California Terminal Company, one of the latest companies to file articles of incorporation, proposes to build a railroad from San Rafael to Sacramento through Marin, Sonoma, Napa, Solano, Yolo and Sacramento counties. The company was incorporated less than a month ago, and the action in obtaining rights of way indicates early construction of the road.

FRESNO, CAL.—Seven hundred and fifty tons of steel are now en route to Fresno and work on the second unit of the Fresno Interurban Railway Company's line from Fresno avenue to the Normal school will be started the last of this month, providing the franchise be granted by the supervisors by that time. The route to the Normal school will be along Fresno avenue for one quarter of a mile to Mahoney, thence north to Weldon avenue, and out that thoroughfare to the Normal school. Just as soon as the work is completed on the unit to the Normal school construction will be started on the extension of the present line to Clovis. The extension will start from the end of the first unit in Alvina Heights.

DIXON, CAL.—Celebrating the inauguration of passenger and freight service over the Sacramento Valley Electric Railroad Company's railway between Dixon Junction and Dixon, the company carried passengers free last Saturday. The line, which is 12 miles long, is the first unit in a system of 150 miles to be constructed between Rio Vista on the Sacramento River to Red Bluff at the northern end of the Sacramento Valley. The Sacramento Valley Electric Railroad Company is financed by the people along the route of the line. Extension of service from Dixon to Woodland, Willows, Corning, Tehama and Red Bluff will be begun shortly. The new railway has a working agreement with the Oakland, Antioch & Eastern Railway, connecting with the latter at Dixon Junction. The Sacramento Valley road will connect regularly with the main line trains of the Oakland, Antioch & Eastern. The officers of the new company are: George W. Pierce, president; W. N. Woodson, first vice-president; H. W. Manor, second vice-president; H. R. Timms, treasurer; Arthur G. Huston, general counsel; Melville Dozier, Jr., general manager; Louis L. James, auditor.

TELEPHONE AND TELEGRAPH.

NORTH BEND, ORE.—The Coos Bay Telephone Company will install an automatic call system, requiring new telephones and switchboard.

LOS ANGELES, CAL.—That the Home and Pacific States Telephone Companies will resist any effort at consolidation or elimination of either system and thus create a one-phone system, is clearly indicated in the report of ex-Senator Henry E. Carter, secretary of the Wilmington Chamber of Commerce, to that body. The report, which has been adopted by the Wilmington chamber, recommends that no action be taken until the expiration of the Pacific Company's franchise in 1916. The Chamber of Commerce, at Senator Carter's suggestion, has sent a request to the Board of Public Utilities that a franchise to expire when the Pacific franchise shall expire, be granted to the Home company, if any franchise is granted. The Wilmington chamber has withdrawn its opposition to the franchise application of the Home Company, which has been before the utilities body for several week.

ALPHABETICAL INDEX TO ADVERTISERS

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A-1 **American Ever-Ready Works of National Carbon Co.**...
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 **Benjamin Electric Manufacturing Co.**...
Rialto Bldg., San Francisco.

B-3 **Blake Signal and Manufacturing Co.**...
680 Howard Street, San Francisco.

B-5 **Bridgeport Brass Co.**... 4
(See Pierson, Roeding & Co.)

B 7 **Busch-Sulzer Bros.-Diesel Engine Co.**... 3
Rialto Bldg., San Francisco.

C-1 **Century Electric Co.**...11
614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 **Colonial Lamp Works**...
444 Market Street, San Francisco.

C-3 **Crocker-Wheeler Co.**...
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-5 **Crouse, Hinds & Co.**...
Chicago, Ill.

C-4 **Cutler-Hammer Manufacturing Co.**...
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 **D. & W. Fuse Co.**...
(All Jobbers.)

D-2 **Dearborn Drug and Chemical Works.**... 3
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 **Edison Lamp Works of General Electric Co.**...
Rialto Bldg., San Francisco.

E-2 **Edison Storage Battery Supply Co.**... 3
441 Golden Gate Avenue, San Francisco.

E-3 **Electric Agencies Co.**...
247 Minna Street, San Francisco; Gentral Building, Los Angeles.

E-4 **Electric Storage Battery Co.**...
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery Street, San Francisco; Colman Bldg., Seattle.

F-1 **Fairbanks, Morse & Co.**...
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 **Fort Wayne Electric Works of G. E. Co.**...
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G-1 **General Electric Co.**... 14
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H-1 **Habirshaw Wire Co.**...
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H-2 **Hemingray Glass Co.**... 3
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H-4 **Holophane Works**...
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H-5 **Hunt, Mirk & Co.**...
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H-6 **Hubbard & Co.**...
Rialto Bldg., San Francisco.

I-1 **Indiana Rubber and Insulated Wire Co.**...12
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K-1 **Kellogg Switchboard and Supply Co.**...
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K-3 **Klein & Sons, Mathias**...12
579 Howard Street, San Francisco.

K-4 **K-P-F Electric Co.**...
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L-1 **Leahy Manufacturing Co.**...
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L-2 **Locke Insulator Manufacturing Co.**... 3
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M-1 **Mannesmannrohren-Werke**...11
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M-2 **McGlauflin Manufacturing Co.**...
Sunnyvale, Cal.

M-4 **Morse Chain Co.**...
Monadnock Bldg., San Francisco.

M-3 **Moore & Co., Charles C.**...
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; 40 First Street, San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 **Nason & Co., R. N.**...
151 Potrero Avenue, San Francisco.

N-2 **National Conduit & Cable Co., The**...
Trust and Savings Bldg., Los Angeels; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co.**...
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N-4 **New York Insulated Wire Co.**...
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O-1 **Okonite Co. (The)**...12
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P-2 **Pacific States Electric Co.**... 2
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P-4 **Pelton Water Wheel Co.**... 3
2219 Harrison Street, San Francisco.

P-5 **Pierson, Roeding & Co.**... 4
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P-7 **Pittsburgh Piping & Equipment Co.**...12
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S-1 **Schaw-Batcher Company, Pipe Works, The**...
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S-2 **Simonds Machinery Co.**...
117-19-21 New Montgomery Street, San Francisco.

S-3 **Simplex Electric Heating Co.**...12
612 Howard Street, San Francisco.

S-4 **Southern Pacific Co.**...11
Flood Bldg., San Francisco.

S-6 **Standard Underground Cable Co.**...
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T-1 **Thomas & Co., R.**...
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V-1 **Van Emon Elevator Co.**...
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W-1 **Wagner Electric Manufacturing Co.**... 3
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W-2 **Western Electric Co.**...
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, So., Seattle.

W-4 **Westinghouse Electric and Manufacturing Co.**... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Bldg., Seattle; Paulsen Bldg., Spokane.

W-5 **Westinghouse Machine Co.**...
141 Second Street, San Francisco.

W-6 **Westinghouse Lamp Co.**...
(See Westinghouse Electric and Manufacturing Co.)

W-7 **Weston Electrical Instrument Co.**...
682 Mission Street, San Francisco.

W-8 **Western Pipe & Steel Co.**...
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.